PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

MAR 8 1926

55

ECONOMIC GEOGRAPHY

JANUARY

1926

VOL. II
NO. 1

Published Quarterly by

CLARK UNIVERSITY

Publication Office, 10 Ferry St., Concord, N. H.
Editorial Office, Worcester, Massachusetts.

OUR CONTRIBUTORS

Mr. Markham, president of the Illinois Central System and chairman of the board of directors of the Central of Georgia Railway Company and the Ocean Steamship Company of Savannah, has directed the development of the Illinois Central System to its present rank as one of the most efficient railway properties in the country. By dealing frankly and freely with his patrons concerning railway problems, Mr. Markham has accomplished wonders toward bringing about a better understanding between the public and the railroads. Under his direction the Illinois Central System has performed outstanding service in promoting the agricultural and industrial development of the territory traversed by its lines. During the World War, Mr. Markham was regional director under the United States Railroad Administration.

Mr. Jonasson has been a member of the instructional staffs of the University of Commerce in Stockholm, and the University of Stockholm, in both of which he has studied. He is now on leave of absence from the University of Stockholm to continue his studies on the distribution of the small grains, at the United States Department of Agriculture and Clark University. During the past summer he has toured Canada and western United States studying land utilization in the various agricultural regions, and particularly the distribution of the small grains, the field of economic geography in which he has specialized and in which he is most interested. His knowledge of agriculture is accurate and first hand.

Dr. Dietrich, professor of economic geography at the University of Breslau, Germany, and Fellow of the American Geographical Society of New York, has been in the United States since July, studying our land and industries; he will remain until spring. His recent book "Deutschland" (Breslau, 1925) has received considerable attention. He is also the author of numerous articles descriptive of distinctive German regions, the Mosel Valley and the Rhoen Mountains, and many articles and maps of Upper Silesia in German, English, and French.

Miss Mason, in this her first published article, indicates the field in which she has chosen to work. A graduate of Wellesley College, she specialized in Geography at Clark University from which she received her Master's degree last June. She is now instructor in Geography at the University of Illinois. Miss Mason knows of the cranberry industry from personal study in the field, and intimate acquaintance with the region she describes in this article.

Dr. Jones is Professor of Geography in the University of London, and head of the Geographical Department at the London School of Economics. As a lecturer in geography in connection with the London & North Eastern Railway educational classes he has specialized in the Economic Geography of northern and eastern England. He was a visiting lecturer to the Geographical Department of Chicago University for the 1925 Summer Quarter. He is the author of a Geography of North England, and the part author of a Geography of North America. He has contributed articles to the Scottish Geographical Magazine, to the Geographical Teacher, and to Economica.

Mr. Merriam, a Dartmouth graduate, was for two years connected with Robert College in Constantinople. Later, as a graduate student at the University of Chicago, he gave particular attention to various geographical relationships of the Near East. He is familiar, therefore, with the life and the industries of that region, as well as the literature. At the present time he is fitting himself for the United States Foreign Service.

Dr. James is assistant professor of geography at the University of Michigan. He has recently completed studies in Trinidad, B. W. I., and several articles as a result of that study are forthcoming, among them: "The Climate of Trinidad" in the Monthly Weather Review; "The Pitch Lake Community" in the Journal of Geography, and "A Geographic Reconnaissance of Trinidad" in Economic Geography.

Copyright 1926
by
Economic Geography
Clark University
Wallace W. Atwood, Pres.
Worcester, Mass.

ECONOMIC GEOGRAPHY

CONTENTS FOR JANUARY, 1926

PAGE

THE DEVELOPMENT, STRATEGY AND TRAFFIC OF THE ILLINOIS CENTRAL SYSTEM 1
C. H. MARKHAM, *President, Illinois Central System*

THE AGRICULTURAL REGIONS OF EUROPE 19
OLOF JONASSON, *Economic Geographer, Geographic Institute of Stockholm, Sweden*

THE PRESENT ECONOMIC CONDITION OF GERMANY 49
BRUNO F. A. DIETRICH, *Economic Geographer, University of Breslau*

THE CRANBERRY INDUSTRY IN MASSACHUSETTS 59
CAROL Y. MASON, *Geographer, University of Illinois*

THE BRITISH FISHERIES 70
LL. RODWELL JONES, *Professor of Economic Geography, University of London*

THE REGIONAL GEOGRAPHY OF ANATOLIA 86
GORDON P. MERRIAM, *Geographer*

GEOGRAPHIC FACTORS IN THE TRINIDAD COCONUT INDUSTRY 108
PRESTON E. JAMES, *Assistant Professor of Geography, University of Michigan*

REVIEWS OF GEOGRAPHIC BOOKS 126

OUR CONTEMPORARIES 136

GEOGRAPHIC NEWS 139

ECONOMIC GEOGRAPHY

Published Quarterly by

CLARK UNIVERSITY, at 10 Ferry Street, Concord, N. H.

Editorial Office: Clark University, Worcester, Massachusetts.

PRICE ONE DOLLAR A NUMBER FOUR DOLLARS A YEAR

Entered as second class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879.

Copyrighted 1926.

TRANSPORTATION

TRANSPORTATION has ever constituted one of man's problems. Transportation of self was the first concern of primitive man as he sought his shelter and sustenance and hied himself away from his predatory enemies. Transportation of self and family increased his concern, as he advanced culturally and socially and assumed responsibility for his children and their mother. Transportation of self and family and belongings further increased his concern as he approached civilization; and when he became civilized, his activities and industries differentiated, and his fellows throughout the world segregated and localized in far scattered groups and states, his concern became a problem that he could only partially solve.

As his problem developed, his progress in means of transportation became accelerated. The primitive raft and log gave way to canoe and boat, the wheeled vehicle and the sledge added to the capacity of his beasts of burden, and group effort supplanted individual endeavor. Then came sails, and keel and rudder for boats, maps and astrolabe, and compass and beacons, for sea-travel; and roads, and bridges, and inns, and way-stations for land travel.

All the time the relationships between men became more extended and complicated. Oman and Yemen traded with Madagascar, Phoenicia with Cornwall, Rome with the Baltic lands; Abraham wandered to Ur and Isaac to Egypt, the three wise men of the East came to kneel at the cradle of Jesus, Marco Polo traveled through China, and Columbus found the new world. Free interchange of goods, of arts and sciences, and of ideas followed improved transportation.

Then man applied steam to transportation. Steam ships speeded across the widest seas, independent of wind and weather; steam trains rushed over railways laid from shore to shore of the widest lands, across the plains, through marsh or desert or forest, over mountain pass and mighty stream. Gasoline made possible the automobile and the airplane; the airplane made the air another of man's pathways; land, and sea, and air are now marked by his trails.

Thus reads the romance of transportation. The great trade routes of the seven seas; the railway nets of every continent; the post, the telephone and telegraph, the radio; the thousands of men and women engaged in the work of trade and transport; all these have made the whole world the granary, the factory, the school, the playground, the theater for every civilized man and woman and child, staving off famine and starvation, lengthening human life, adding to its interest and its richness;—and still the problem of adequate transportation keeps man busy in solving its newest phases!

ECONOMIC GEOGRAPHY

VOL. II JANUARY, 1926 No. 1

THE DEVELOPMENT, STRATEGY AND TRAFFIC OF THE ILLINOIS CENTRAL SYSTEM

C. H. Markham
President, Illinois Central System

THE Illinois Central System[1] today consists of 6,550 miles of line, represents a property investment of approximately $620,000,000, and operates in fourteen states of the Mississippi Valley: Alabama, Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Nebraska, South Dakota, Tennessee and Wisconsin (Fig. 6).

FIGURE 1.—The Chicago Terminal of the Illinois Central System, the great arterial outlet from the heart of America's vibrant agricultural industry. This terminal is most advantageously located along the Lake Front, and lies along one side of the very center of the city, the Loop.

[1] The Illinois Central System has since 1909 included the Central of Georgia Railway Company and its subsidiary lines, which form a 1,900-mile railway system operating in Georgia, Alabama and Tennessee. These lines are operated as a separate unit, with an autonomous organization. For the purpose of this paper they are considered only incidentally as part of the Illinois Central System. Statements in respect to the properties, traffic, etc., of the Illinois Central System, unless otherwise indicated, exclude the Central of Georgia.

I. DEVELOPMENT

The Illinois Central Railroad Company, the parent road of the present Illinois Central System, was chartered in February, 1851, by the general assembly of Illinois. The charter conveyed to the company it created the two and one-half million acres of public lands granted to the state by an Act of Congress of September 20, 1850, and provided for "the construction of a railroad from the southern terminus of the Illinois and Michigan Canal to a point at or near the junction of the Ohio and Mississippi rivers, with a branch to Chicago on Lake Michigan, and another via the town of Galena to Dubuque in the State of Iowa."

The Illinois Central was the first of the land grant railroads. The land grant

experiment as tried out with the Illinois Central proved so beneficial to the federal government in disposing of its public lands and in opening up remote and otherwise inaccessible regions for settlement that the policy was followed elsewhere. Railway construction, particularly in the West, was greatly stimulated as a result.

Pioneer Conditions

When the lines of the proposed Illinois Central Railroad were surveyed, in the spring of 1851, there were fewer than 100 miles of railroad in Illinois—the Galena & Chicago Union Railroad, 42 miles in length, between Chicago and Elgin, now part of the Chicago & North Western Railway System; the Springfield & Sangamon Railroad, 45 miles in length, between Meredosia and Springfield, now part of the Wabash Railway, and the Aurora Railroad, eleven miles in length, extending westward from West Chicago, now part of the Burlington. No railroad had yet reached Illinois from the East, and not a single railway line crossed the 705.5-mile right-of-way of the proposed Illinois Central Railroad throughout its length. The Chicago and Illinois rivers, connected by the Illinois and Michigan Canal, which had been completed in 1848, formed the only route of commerce between Lake Michigan and the Mississippi River.

The located line passed through some of the most sparsely settled portions of the state. The following excerpt from a letter written by one of the financial backers of the enterprise in October, 1853, at the close of a tour of inspection through Illinois made by horse and carriage, presents an illuminating description of conditions in the state two years after the construction of the railroad was begun:

"It surprised me to see so very small a portion of these vast prairies under cultivation, and I just begin to realize their vast extent. There is substantially no population except upon the streams and timber, which are generally found together. To ride a whole day over nothing but prairie, with the exception of a very narrow strip of sparse timber at one or two points, and during a great portion of the time without the sight of a single tree of any kind or a human habitation in any direction, while your view is limited only by the distant horizon, gives one very peculiar sensations, and impresses him with new ideas as to the extent of these vast meadows. Whenever we do find a crop of corn it is of great height and apparently of heavy yield, and it is quite apparent that when even one-quarter of the land shall be under cultivation, the local business of the road in carrying the product to market must be immense. When I undertake to make an estimate on this subject, results are produced so astounding as to seem scarcely possible."

The Main Line

The construction of the original Illinois Central Railroad was begun in 1851 and completed in 1856. The railroad followed the lines laid down in the state charter, extending from Cairo, at the mouth of the Ohio River, the northern terminus of year-round navigation on the Mississippi River, to LaSalle, at the western terminus of the Illinois and Michigan Canal, with branches from LaSalle to Dunleith (now East Dubuque), on the Mississippi River opposite Dubuque, Iowa, and from near Centralia to Chicago. In 1851 the principal towns along the proposed main line of the Illinois Central were Cairo, Jonesboro, Vandalia, Decatur, Bloomington, Clinton and LaSalle. Dixon, Amboy, Freeport and Galena were the only towns on the proposed Dubuque branch, and Urbana, Kankakee and Chicago were the only towns on the proposed Chicago branch. Aside from Chicago, Galena and LaSalle with populations of 30,000, 6,000 and 3,000, respectively, none of these towns had more than one or two thousand inhabitants. The Illinois Central, therefore, was in every sense a pioneer railroad.

The original Illinois Central Railroad was designed to serve the following purposes: To open up the rich interior of

Illinois to settlement and agricultural development; to form a direct year-round "portage" between Chicago, the lake port, and Cairo, the river port; to accommodate traffic which could not be moved by canal or river during the winter months on account of ice; to render the lead and zinc mines of northwestern Illinois and southwestern Wisconsin more accessible to markets, and to form the northern portion of the Lakes-to-Gulf railroad of which many forward-looking statesmen had dreamed.

At that stage of national development the commerce in the Mississippi Valley, which had developed gradually over a period of more than a century, moved for the most part northward and southward by way of the Mississippi River. New Orleans, then as now the chief seaport of the Mississippi Valley, was the logical outlet and intake for the foreign commerce of that territory. Therefore, a north-and-south railroad was in harmony with the currents of the Mississippi Valley traffic of that period.

The construction of a railroad northward from the port of Mobile, on the Gulf Coast, to a proposed connection with the Illinois Central at Cairo aroused the citizens of New Orleans to action. The New Orleans, Jackson & Great Northern Railroad was organized in 1852 by New Orleans capitalists, and plans were formulated for the construction of a line from New Orleans northward to Canton, Miss., with the following objects in view: To establish a connection at Canton with the railroad which was proposed to be built northward from that point and ultimately to connect with the Illinois Central at Cairo, thus completing the Lakes-to-Gulf rail route; to promote traffic between the upper Mississippi Valley and New Orleans in competition with the Mobile route, and thus maintain the supremacy of New Orleans as a Gulf port; and to develop the interior of Louisiana and Mississippi and facilitate the transportation of cotton and lumber to New Orleans.

FIGURE 2.—The Illinois Central Bridge across the Ohio River at Cairo first completed the through rail route between Chicago and New Orleans in 1889.

By 1861 the New Orleans road had reached Jackson, Tenn., and the Mobile road had reached Columbus, Ky., twenty-one miles south of Cairo. Further construction was suspended until after the Civil War, and it was not until 1873 that the New Orleans road reached East Cairo, Ky., where a connection was established with the Illinois Central by means of a train ferry across the Ohio River. In 1882 the Illinois Central System acquired the New Orleans-East Cairo line and established a through Illinois Central System service, and in 1889 the through rail route between Chicago and New Orleans was completed by the construction of a bridge across the Ohio River at Cairo (Fig. 2).

This through line of 912 miles between Chicago and New Orleans, affording

double-track facilities or their equivalent its entire length, constitutes the backbone of the present Illinois Central System, supported by a vast network of supplementary lines which add greatly to the economic strength of the system.

Supplementary Lines

The most important of these supplementary lines extends from Omaha-Council Bluffs, Sioux City and Sioux Falls eastward to Chicago, with branches to Onawa, Iowa, Albert Lea, Minn., Cedar Rapids, Iowa, Madison, Wis., and Dodgeville, Wis. This line and its branches, with a total of 1,073 miles, tap the great grain and livestock belt of Iowa, Nebraska, Minnesota, Wisconsin and South Dakota.

The several lines radiating from Clinton, Rantoul and Decatur, extending through central Illinois and western Indiana, serve a region which produces a great deal of corn, wheat and livestock. The close-woven network of lines about Carbondale and Herrin, in southern Illinois, taps the vast coal fields of that region, and the group of roads centered around Princeton and Morganfield, Ky., serves the large coal fields of western Kentucky. The extensive network of roads traversing the fertile Delta region of northwestern Mississippi was built to serve numerous lumber mills as well as to handle the heavy cotton production of that region.

The line between Gilman and Springfield, Ill., was acquired in 1877 to establish a direct route between Chicago and Springfield, the state capital and an important commercial center, and the line between Springfield and East St. Louis was acquired in 1900 to complete a direct route between Chicago and St. Louis.

The line between Effingham, Ill., and Indianapolis, Ind., acquired in 1911, gives the Illinois Central System a longer haul on its traffic originating at or destined to Indianapolis and reaches the stone and coal deposits southwest of that city. The line between Peoria, Ill., and Evansville, Ind., which serves an important agricultural and coal region, was acquired in 1900 to gain entrances to those two important cities, as well as to secure additional centers for distribution and increase the producing capacity of the system's territory.

The line between Memphis and Louisville, acquired in 1897, gives the Illinois Central System a longer haul on traffic moving between Southern points and Louisville, forms a direct route between Memphis and the North, and affords access to the coal- and tobacco-producing regions of Kentucky. The Yazoo & Mississippi Valley line from Memphis through Clarksdale, Vicksburg and Baton Rouge to New Orleans was acquired in 1892, adding to the system an alternate route between Memphis and New Orleans and establishing important connections with lines to and from the Southwest at the Vicksburg, Natchez and Baton Rouge gateways. The completion of the line between Jackson, Tenn., and Birmingham, Ala., in 1908, gave the Illinois Central System access to Birmingham and the industrial region of northern Alabama and direct connections via the Central of Georgia Railway (which is, as noted, a part of the greater Illinois Central System) with Georgia and Florida points, as well as with the Atlantic seaboard at Savannah.

The newly acquired Gulf & Ship Island Railroad, which provides a direct line between Jackson and Gulfport, Miss., penetrates the most important lumber-producing region in Mississippi and gives the Illinois Central a second outlet to the Gulf of Mexico (Figs. 3, 4, 5, and 6).

At present a new line is being constructed between Edgewood, Ill., and Fulton, Ky., which will meet the need for additional facilities and will shorten by twenty-three miles the route between Chicago and the South.

II. STRATEGY

The success or failure of any business enterprise is finally determined by its income account. A railroad may provide good transportation service under wise and careful management and yet, be-

FIGURE 3.—The Illinois Central System in 1856 was a forked intra-Illinois railroad of which one branch ran from Galena in the west, and the other from Chicago in the east, to unite at Centralia and continue on to Cairo.

FIGURE 4.—The Illinois Central System in 1875 crossed two states, Iowa and Illinois, the two states which were to take the lead in the agricultural progress of the later nineteenth century.

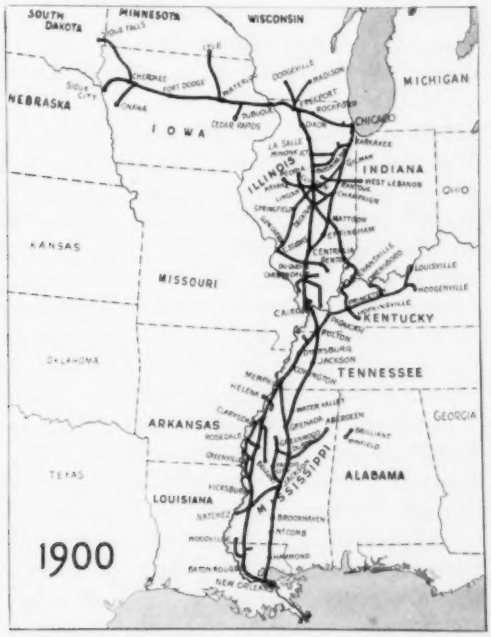

FIGURE 5.—The Illinois Central System in 1900, extending to the Gulf, had become a valley network of rails that carried a heavy tonnage of the rich products of the fertile farms, the green pastures, and the profitable plantations of "The Valley of Democracy."

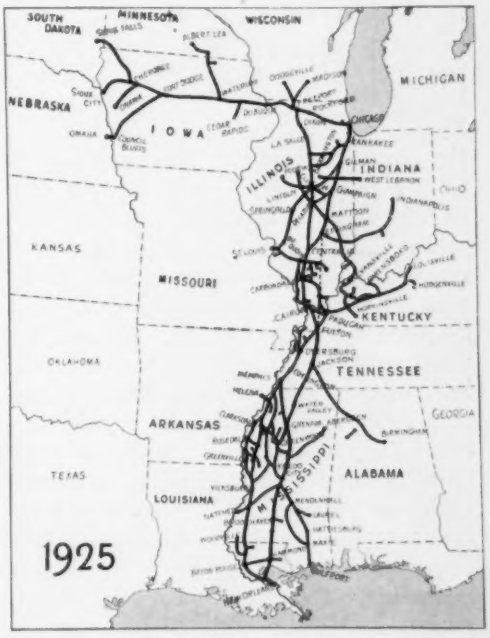

FIGURE 6.—For the first twenty-five years of the twentieth century the Illinois Central System has improved its service and consolidated its interests, for the benefit of the populous district that supports it and to the consequent profit to the railroad itself.

cause of unfavorable conditions in its territory, inadequate rates or some other combination of causes, fail to make sufficient net after expenses and taxes to meet its fixed charges. This was the case with hundreds of pioneer railway properties. The Illinois Central System, however, holds the enviable record of having met its fixed charges and paid dividends to its stockholders without default since 1860, or almost from its inception.

Natural Advantages

The success, thus measured, of the Illinois System has been due in part to the following advantages: Its fortunate geographical location, the rich agricultural and mineral resources of its territory, the remarkable development of manufactures along its lines and its strategic position with respect to domestic and foreign commerce.

Geographically, the Illinois Central System is located almost in the heart of the North American continent. The fourteen states of the Mississippi Valley in which it operates embrace one-third of the total population of the United States. It connects many of the great industrial and commercial centers of the Mississippi Valley, including Chicago, the second largest city on the continent, and in many respects the leading commercial city of the world; St. Louis, the great manufacturing and distributing center; New Orleans, the second largest port in the country; Birmingham, the "Pittsburgh of the South"; Memphis, the world's leading hardwood lumber market; Omaha, the manufacturing and commercial metropolis of Nebraska, and such other important cities as Sioux City, Sioux Falls, Fort Dodge, Waterloo, Dubuque, Rockford, Madison, Peoria, Bloomington, Springfield, Indianapolis, Decatur, Evansville, East St. Louis, Louisville, Paducah, Jackson, Tenn., Jackson, Miss., Vicksburg, Natchez, Baton Rouge, Hattiesburg and Gulfport.

Unlike many railroads which have to depend on single crops or industries for most of their tonnage and therefore suffer seriously when those crops or industries meet with reverses, the Illinois Central System traverses a region the agricultural, mineral, lumbering and manufacturing production of which is highly diversified. It is consequently little affected by the failure of any one harvest or the slowing down of any one industry. The fourteen states in which the Illinois Central System operates embrace only 26 per cent of the total land area of the United States, but they produce 34 per cent of the nation's bituminous coal, 34 per cent of its lumber, 38 per cent of its cotton, 49 per cent of its tobacco, 69 per cent of its corn, 33 per cent of its wheat, 64 per cent of its oats, 66 per cent of its rice and 46 per cent of its livestock. They contain 37 per cent of the country's railway mileage, or one-eighth of the total railway mileage of the world.

The wide range of climate traversed by the Illinois Central System has an important bearing on the traffic which flows over its lines. The northernmost extremity of the system is at Albert Lea, Minn., north of the 43d parallel, with a mean temperature in January of about 14° and in July of about 73°, and an annual precipitation of about 25 inches. The southernmost extremity is at New Orleans, on the 30th parallel, with a mean annual temperature in January of about 54° and in July of about 82°, and an annual precipitation of about 57 inches. So wide is the climatic variation that while the northern part of the railroad is blanketed in snow and ice and experiencing subzero weather, fields of strawberries and vegetables are ripening under the warm Louisiana sun at the southern end of the line, and peach trees are in bloom along the balmy Gulf Coast of southern Mississippi. Many of the agricultural and forest products of the South are native to that region and cannot be grown successfully in the North, and many of the hardier agricultural products of the North do not thrive in the sub-tropical climate of the Southern states. Hence the interchange of Southern products, such as Southern pine lumber, cotton and cotton

seed products, winter vegetables, fruits, tobacco, berries, sugar, rice and pecans, for the grains, packing house products and hardier fruits and vegetables of the North furnishes the railroad with a large and important part of its tonnage.

The advantages of being a pioneer railroad probably more than offset the disadvantages. The Illinois Central System reached most of what now are the populous centers of its territory when they were scarcely more than settlements. It was the forerunner of hundreds of towns and cities along its lines. Naturally, therefore, it acquired the advantage of exceedingly favorable locations in many of these centers which it would be difficult if not impossible to acquire today.

The Lake Terminal

At Chicago, for example, the Illinois Central terminal occupies a location along the Lake front immediately adjacent to the "Loop" business district, a property that could not be obtained by a railroad today at any price. When this right-of-way was acquired, Chicago had a population of 30,000. The railroad had obtained a right-of-way along the Lake front through the town of Hyde Park to the southern limits of Chicago, near what is now Twenty-Second Street and sought a right-of-way into the city along the south branch of the Chicago River. The city was experiencing considerable difficulty in preventing the encroachments of the Lake upon Michigan Avenue, between Park Row and Randolph Street. It was costly to save the shore line. Neither the city nor the state was financially able to undertake the work. While negotiations over the right-of-way were in progress there occurred a severe storm which created further damage and led to the adoption of an ordinance requiring the Illinois Central to build into the city along the Lake front, construct a breakwater and relieve the city of all further expense in protecting the shore line. The railroad accepted the terms of the ordinance and spent several million dollars in constructing and maintaining the breakwater. Thus the shore line was saved, and the Illinois Central came into possession of a property which today is probably worth several times the entire cost of construction of the original Illinois Central Railroad. At the same time the railroad acquired by prudent purchase the unimproved land upon which its freight yards, dock and elevator facilities are located between Randolph Street and the Chicago River (Fig. 7).

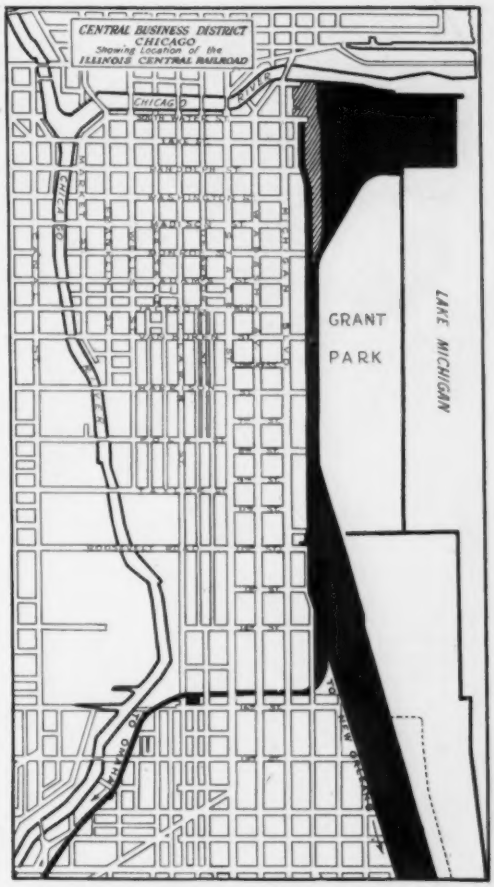

FIGURE 7.—The excellent terminal facilities of the Illinois Central in Chicago in relation to the loop district, Chicago's central business district, are graphically presented in this map.

Prairie Relief

Another pronounced geographical advantage which the Illinois Central has is that of traversing the comparatively level country of the Mississippi Valley.

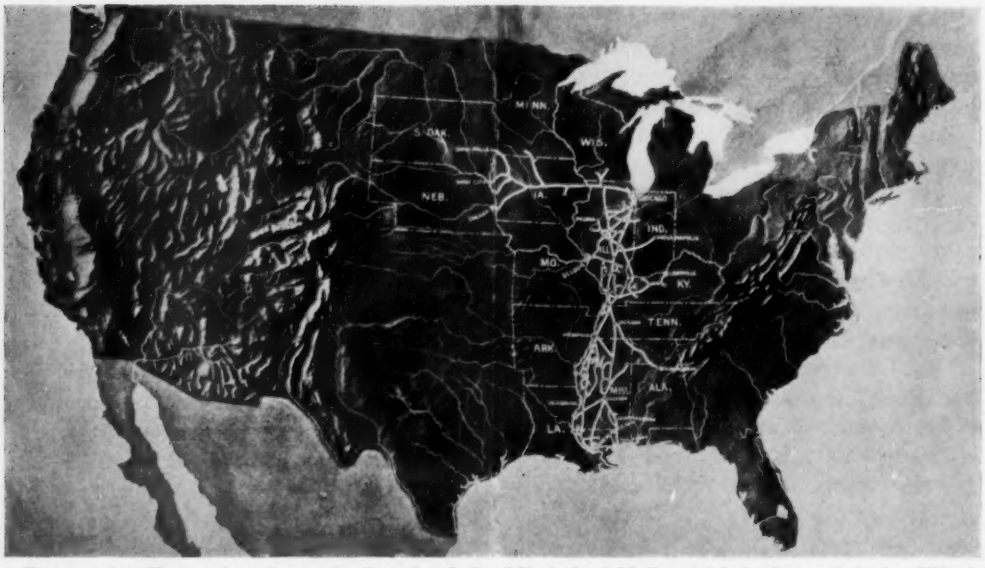

FIGURE 8.—Traversing the entire length of the Mississippi Valley with its low relief, the Illinois Central System constitutes the major connecting system between the Great Lakes and the Gulf of Mexico, and transports much of the freight that moves either northward or southward through the middle of the country. The easy grades and long straight lines of the track have facilitated construction and operation.

Not only did the level topography and light timber growth through this territory render construction easier and less expensive than would have been the case through a more rugged country, but it enabled the construction of a straighter and smoother roadway. Ninety per cent of the original road in Illinois was straight, and the few curves were of such wide radius as to render them an almost negligible factor in the operation of trains. The long and steep grades that have to be overcome on nearly all the Eastern and Western railroads are not so great a factor on the Illinois Central System. The advantages of its comparatively straight and level track enable the operation of long, heavy trains at a much lower tractive effort than is required on the majority of railroads (Fig. 8).

Agricultural Resources

Seventy-one per cent of all land in the fourteen states in which the Illinois Central System operates is in farms, compared with 43 per cent in the thirty-four other states of the Union. In 1923 these fourteen states furnished more than 40 per cent of the total agricultural production of the United States. It is therefore manifest that the Illinois Central System, traversing this rich agricultural region, carries a vast traffic of agricultural products. Although the Illinois Central System embraces only about one-thirty-eighth of the railway mileage of the country, one in every twenty-four carloads of agricultural products handled by the Class I railroads of the United States in 1924 originated on the Illinois Central System.[2]

Mineral Resources

When the Illinois Central Railroad was projected, except for the lead and zinc mines of northwestern Illinois and southwestern Wisconsin, the mineral resources of the Mississippi Valley were entirely undeveloped. Coal had not come into extensive use as fuel. In 1855 the mining of 20,000 tons of coal in the vicin-

[2] With the Gulf & Ship Island Railroad, which became part of the Illinois Central System in 1925, included, the Illinois Central System originated one in every twenty-three carloads of agricultural products handled by the Class I railroads in 1924.

ity of LaSalle and DuQuoin, Ill., for domestic consumption in those and neighboring towns led the president of the Illinois Central in his annual report to make the prophetic statement that he

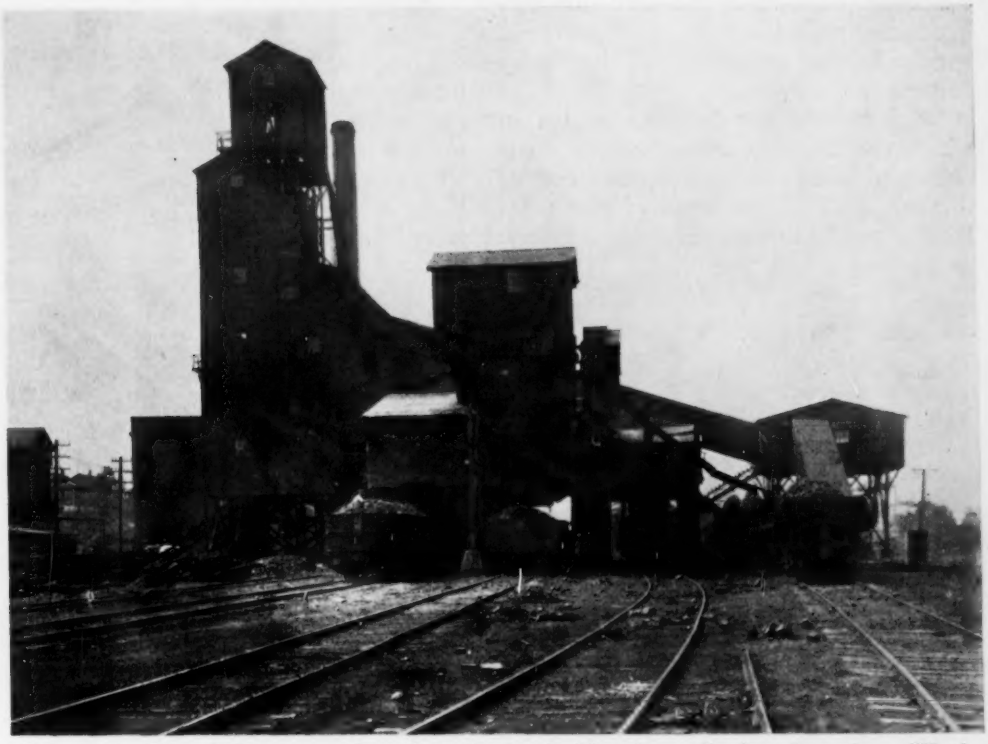

FIGURE 9.—One of the mammoth coal tipples in the bituminous district of southern Illinois, whence comes the cheap fuel for the great industries rapidly developing throughout the district tributary to the Illinois Central System.

was "fully persuaded that coal traffic would eventually become one of the most important elements of profit to the road." By means of railway transportation the coal mines of Illinois, Indiana and Kentucky found markets at Chicago, St. Louis, Indianapolis, Louisville, Memphis and other populous industrial centers. As the territory developed and the railroads helped to create markets, such commodities as sand, gravel, stone, clay and fluorspar came to contribute substantially to the system's freight tonnage. In 1919 there were 3,868 producing mines and quarries, employing 254,234 workmen, in the fourteen states of the Mississippi Valley in which the Illinois Central System operates, and their total production that year was valued at $660,006,000, or 21 per cent of the total value of all mine and quarry products in the United States. In 1924 the Illinois Central System transported 25,703,690 tons of mineral products, approximately two-thirds of which was coal (Fig. 9).

Lumber Resources

The strategic position of the Illinois Central System in relation to the lumber industry is at once apparent. The United States uses about two-fifths of the total world consumption of wood and wood products. Not many years ago the states of Michigan, Minnesota and Wisconsin produced a surplus of forest products, and because of the short haul they were the principal sources of supply for the consuming states of Illinois, Indiana, Iowa, Ohio and Missouri. Today, however, with the exception of Maine and New Hampshire, every state

north of the Ohio and Potomac rivers and east of the Rocky Mountains, as well as Kentucky, consumes more lumber than it produces, while Louisiana, Mississippi, eastern Texas, Arkansas and Alabama form the principal lumber-producing region and the main source of surplus lumber supply east of the Rocky Mountains.

During 1922 the fourteen states in which the Illinois Central System operates produced 10,853,000,000 feet of lumber, or 34.5 per cent of the total lumber production of the United States. The four states of Louisiana, Mississippi, Arkansas and Alabama milled 8,494,000,000 feet, or 26.9 per cent of the total production in the country (Fig. 10). Therefore, the Illinois Central System, with its network of lines traversing the principal lumber-producing regions of Mississippi, affording direct connections with lumber-producing points in Louisiana, Alabama and Arkansas and serving directly the great markets of the Central West, is most advantageously located as a lumber carrier.

Of the 3,780,341 carloads of forest products originating on the Class I railroads of the United States in 1924, 182,462 carloads, or 4.8 per cent, originated on the Illinois Central System.[3] In 1924 the Illinois Central System transported approximately one-sixth of all the lumber at Chicago, the world's largest lumber market, and more than was delivered by any other railroad in this market.

FIGURE 10.—Yellow pine lumber mill on the Illinois Central in Mississippi. The four states of Mississippi, Louisiana, Arkansas, and Alabama produce about one-fourth the country's lumber.

Industrial Activity

The vast agricultural, mineral and lumber resources of the states of the Mississippi Valley, their excellent transportation facilities, their central location with respect to population and accessibility of fuel and raw materials, have given the territory traversed by the lines of the Illinois Central System every advantage in manufacturing, and the phenomenal industrial growth of the Mississippi Valley region has contributed greatly to the economic strength of the railroad.

In 1921 there were 51,768 manufacturing and industrial establishments, employing 1,980,609 persons, in the fourteen states in which the Illinois Central System operates. More than ten billion dollars were invested in these enterprises, and the value of their products in 1921 was $10,898,837,000, or approximately one-fourth of the total value of all products manufactured in the United States in that year.

[3] With the Gulf & Ship Island Railroad, which became part of the Illinois Central System in 1925, included, the forest products originated by the Illinois Central System in 1924 amounted to 220,588 carloads, or 5.8 per cent of the whole.

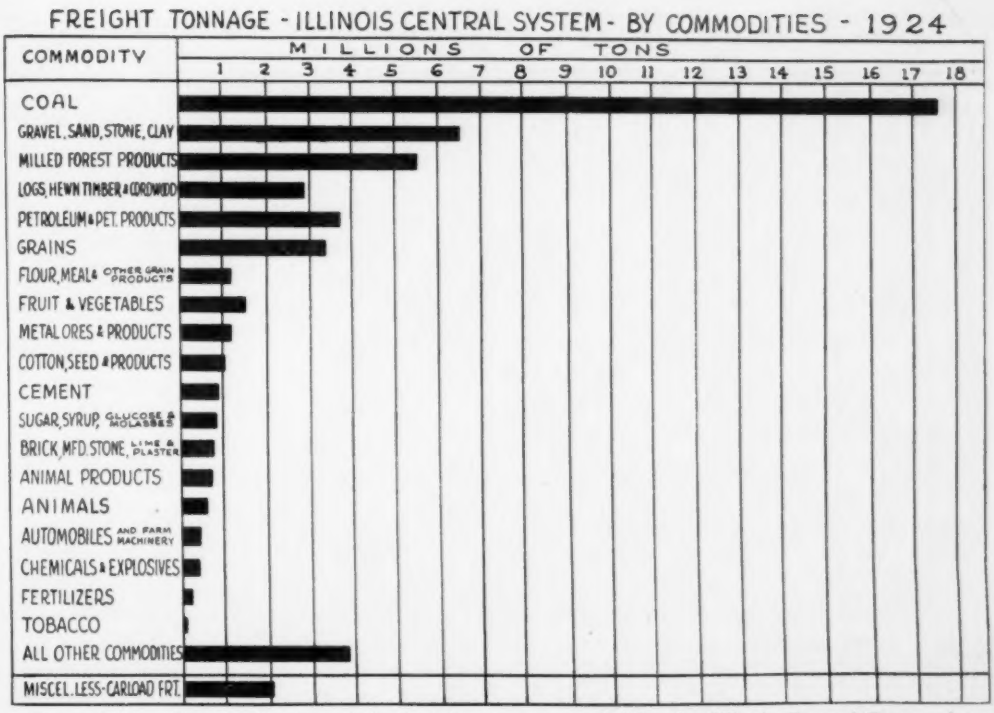

FIGURE 11.—The distribution of the freight tonnage carried by the Illinois Central System is an index to the character of the industries and the products of the whole Mississippi Valley.

The twelve principal manufacturing cities on the Illinois Central System, with the number of their manufacturing establishments and the value of their products, both as of 1919, are:

	Number of Plants	*Value of Products*
Chicago	10,537	$3,657,424,471
St. Louis	3,205	871,700,438
Omaha	561	452,236,634
Indianapolis	1,004	398,666,553
Louisville	767	204,565,727
New Orleans	873	182,798,561
Sioux City	251	146,393,134
Birmingham	329	127,214,048
Memphis	379	117,717,829
East St. Louis	157	77,292,812
Rockford	312	74,918,953
Evansville	299	70,230,419

The location of industries is contingent upon several factors, including adequate transportation facilities, accessible raw materials, favorable freight rates, proximate markets and adequate labor supply. Due to its unique location, its long-established reputation for efficient and reliable service, the abundance of raw materials along its lines and the great industrial centers which it serves, the Illinois Central System has become one of the leading industrial railroads of America. Along its lines are located many thousands of industrial plants, manufacturing almost every conceivable product entering into the commerce of the country, and this great diversity of manufactures gives the railroad a stability and uniformity of tonnage which many railroads do not possess (Fig. 11).

The advantage of being the pioneer railroad is an important factor in the development of industrial traffic particularly. In many towns and cities on the present Illinois Central System it was the first railroad in the place. Hence many of the industries in these centers are to be found along its lines and connected by sidetracks. Although other railroads have since entered these towns, the Illinois Central System has maintained its supremacy in them as an industrial carrier because of its superior location, locally and with respect to the great

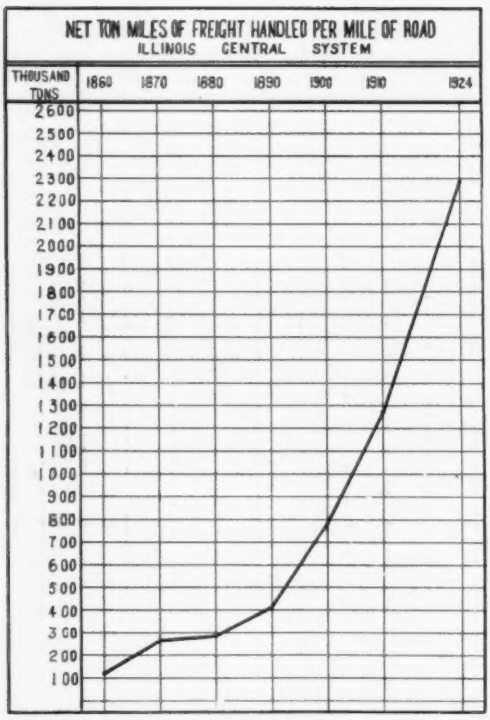

FIGURE 12.—The rapid rise in the amount of freight tonnage carried by the Illinois Central System indicates the rapid growth of the district it serves, both in population and industry, and of the capacity of the railroad to care for the growing business.

markets of its territory, and its long experience in the handling of industrial traffic.

Off-line Domestic Connections

A study of the railway map of the United States will disclose the strategic geographical position of the Illinois Central System with reference to off-line domestic trade and to foreign commerce. Aside from the products originating on its own lines, this railroad, owing to its location with respect to the great markets and ports of the Mississippi Valley, draws a vast tonnage from connecting lines. Of the total revenue tonnage handled by the system in 1924, 59.9 per cent originated at points on the system, and 40.1 per cent was received from connections. The Illinois Central System has more than 500 connections with 160 railroads, reaching into every part of the United States, Mexico and Canada. Its principal gateways and the number of important connecting railroads at each gateway are:

	Connecting Railroads
Chicago	22
St. Louis and East St. Louis	19
Peoria	10
New Orleans	9
Birmingham	9
Omaha and Council Bluffs	9
Louisville	8
Memphis	8
Evansville	7
Indianapolis	6
Springfield	6
Sioux City	5
Baton Rouge	3

Tonnage from the fruit- and vegetable-growing regions of the Pacific Coast, the livestock regions of Wyoming, Colorado and Nebraska and the grain-producing regions of the Northwest reaches the Illinois Central System at Omaha, Sioux City, Sioux Falls, St. Louis, Peoria and other gateways. Manufactured products of the great industrial cities of Michigan, Ohio, Pennsylvania and the East, destined to Western, Southwestern and lower Mississippi Valley points, are received by the Illinois Central System at Chicago, Indianapolis, Louisville and other points. Lumber, petroleum and other commodities from the Southwest come through the gateways of New Orleans, Baton Rouge, Natchez, Vicksburg, Memphis and St. Louis. The flow of traffic from Florida, Georgia and eastern Alabama is largely through Martin, Tenn., and Birmingham.

The advantageous geographical location of the Illinois Central System with respect to foreign commerce and the further advantage of owning its own port facilities are assets of first importance to the system.

Port Facilities

At New Orleans, the second largest port in the United States in total tonnage of exports and imports and total net tonnage of shipping engaged in foreign trade, the Illinois Central System owns exten-

FIGURE 13.—The terminal facilities of the Illinois Central System at New Orleans, its southern outlet, have been developed with great care and heavy expense. They are now among the finest in the country. A portion of Stuyvesant Docks is shown above.

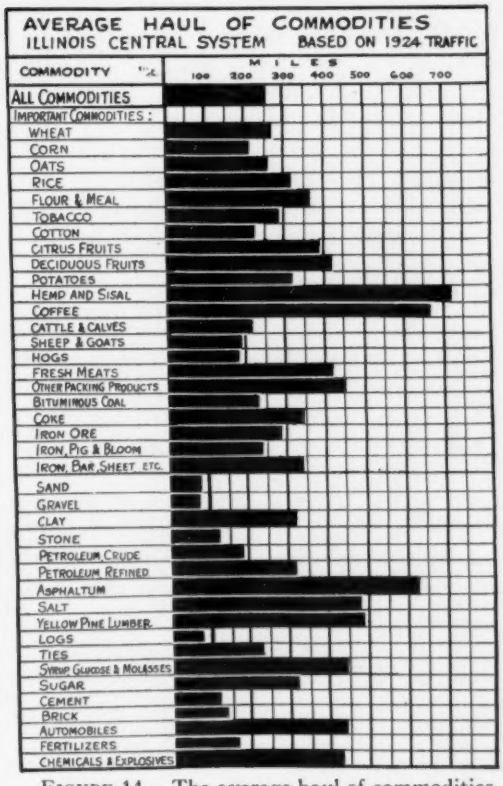

FIGURE 14.—The average haul of commodities is an interesting study in the economics of transportation.

sive docks, elevators and warehouses, equipped with modern loading and unloading machinery (Fig. 13).

The recent acquisition of the Gulf & Ship Island Railroad has added a second Gulf port to the Illinois Central System. At Gulfport, the only deep-water harbor on the Mississippi Coast, the system now owns a pier more than a mile in length and a wharf several hundred feet in length, where cargoes are loaded and unloaded directly between cars and ships. Gulfport is one of the leading lumber and naval stores ports on the Gulf Coast.

The Ocean Steamship Company, a subsidiary of the Central of Georgia Railway Company (which is, as noted, a part of the greater Illinois Central System), owns commodious marine terminals at Savannah, Ga., the largest naval stores port of the country and the third largest cotton port in the world.

A fourth deep-water port on the Illinois Central System is at Baton Rouge, on the lower Mississippi River. Baton Rouge is now a port of entry under United States customs regulations.

The Panama Canal

With the opening of the Panama Canal the traffic map of the world underwent an important change, which has been reflected in the lessened freight tonnage of several transcontinental railroads. Of the 23,958,839 cargo tons (28,606,650 short tons) which passed through this waterway during the year ended June 30, 1925, approximately 40 per cent was to and from Atlantic and Pacific coast ports of the United States. In common with other latitudinal railroads engaged in the transportation of transcontinental tonnage, the Illinois Central System's line between Chicago and Omaha suffers from canal competition, but new traffic has developed to and from the Panama Canal over the longitudinal lines of the system. The Panama Canal may therefore well be considered an asset to the Illinois Central System, because of its geographical location, although a liability to the latitudinal transcontinental lines. As the trade of the United States continues to grow with the increasing industrialization of its people, the growth of its population, and the development of its interest in foreign markets, the Panama Canal will become of increasing importance as a factor in the business of the Illinois Central; an importance that even today is significant, and of consideration in the policies of the system.

The following analysis of receipts and deliveries by the Illinois Central System at New Orleans of traffic passing through the Panama Canal for the month of June, 1925, illustrates the diversity of markets and producing regions thus served:

	Per Cent of Total
Imports:	
From West Coast of South America	85
From Asia	14
From West Coast of United States	1
	100
Exports:	
To West Coast of United States	50
To Africa	28
To West Coast of South America	19
To Asia	3
	100

The advantageous geographical location of the Illinois Central System with respect to Panama Canal business is shown by the following comparisons of distances from several important cities in the Mississippi Valley to Colon via New York and via the Illinois Central System and New Orleans:

	Via New York Miles	*Via New Orleans Miles*
Chicago	2,886	2,315
St. Louis	3,039	2,102
Indianapolis	2,799	2,291
Omaha	3,379	2,740
Milwaukee	2,971	2,400
St. Paul	3,296	2,716
Minneapolis	3,306	2,735
Detroit	2,667	2,587
Kansas City	3,316	2,379
Louisville	2,845	2,179
Memphis	3,131	1,799
Toledo	2,679	2,559
Duluth	3,365	2,794

Passenger Traffic

While this paper deals mainly with the Illinois Central System as a freight carrier, it may not be amiss to consider briefly its geographical position with reference to passenger traffic. The development of passenger traffic on the Illinois Central has kept pace with the growth of the territory through which it operates. In 1924 the system carried 36,339,704 passengers, or approximately 3.9 per cent of all the passengers carried by the Class I railroads in the United States. This system is one of the principal highways of travel between the Central West and the lower Mississippi Valley, the Southeastern states and Central American points. Suburban passenger service in the Chicago terminal zone, which was begun in 1856, and was given great impetus by the Columbian Exposition of 1893, has become a highly important branch of the company's passenger service. At present the railroad operates 418 suburban trains a day on the Chicago terminal, carrying an average of 87,000 revenue passengers daily.

Public Policies

The Illinois Central System has several noteworthy policies in its relations

FIGURE 15.—The Illinois Central coöperates with the farmers throughout its entire system in every way possible. In Louisiana the railroad does its part in the peak load transportation of cane to the sugar mills and refineries, to aid the farmers in obtaining the maximum sugar from their crop.

with the people of its territory. These policies are in reality a part of the railroad's strategy and pertinent therefore to the subject of this paper. They are: Coöperation with farmers in the production and marketing of crops and livestock; continual improvement of facilities to keep pace with modern usages and current demands; expansion and consolidation along conservative lines; efficient, dependable, courteous service always; dissemination of information relative to the affairs of the Illinois Central System and of the railroads generally; solicitation of constructive criticism and suggestions from the public, and fair, considerate treatment of employes.

III. TRAFFIC

The Illinois Central System in 1924 derived 76 per cent of its total operating revenue from the transportation of freight. Eight leading commodity groups made up approximately four-fifths of the system's freight tonnage in 1924. These groups are: (1) bituminous coal; (2) lumber, logs and ties; (3) gravel, sand, stone and clay; (4) grain and grain products; (5) petroleum and petroleum products; (6) fruits and vegetables; (7) cotton, cottonseed and cottonseed products; (8) livestock.

Bituminous Coal

1. In 1924 the Illinois Central System transported 17,604,948 tons of bituminous coal, 94 per cent of which originated or was received from connecting lines in Illinois, Kentucky and Indiana, the three principal coal-producing states on the system. Approximately two-thirds of the coal handled by the system originated at on-line mines, and one-third was received from connections. The Illinois Central System is the principal carrier of coal from the combined fields of Illinois, Indiana and Western Kentucky. The heaviest flow of coal is from these fields to Chicago, which is the consuming and distributing point for more than 16,000,000 tons of bituminous coal from these fields annually. A second

important traffic flow is to St. Louis and East St. Louis, which consume in the aggregate 6,000,000 tons of coal from these fields annually. Approximately two-thirds of the coal originating on the system's western Kentucky lines moves to Louisville, Memphis, Paducah and various points in Mississippi and Louisiana for consumption or transshipment.

While coal is consumed in large quantities throughout the year, the demand is much heavier during the winter, and the seasonal movement reaches its peak during the winter months.

Lumber, Logs, and Ties

2. Eighty-five per cent of the lumber production in the territory in which the Illinois Central System operates is in the states south of the Ohio River. Since the Northern states predominate in population and industrial development and do not produce as much lumber as they consume, the principal movement of forest products on the system is from points south to points north of the Ohio River. Of the 7,910,841 tons of lumber, logs and ties transported by the Illinois Central System in 1924, 48 per cent originated or was received from connections in Mississippi, 17 per cent in Tennessee and 10 per cent in Louisiana. More than 3,500,000 tons were delivered to points in Illinois. Deliveries by the Illinois Central System of lumber at Chicago exceed that of any other railroads, its deliveries at this point in 1924 being 633,127,000 feet. A considerable quantity of lumber also moves to Gulfport and New Orleans for export.

In many northern regions where lumbering operations are carried on largely during the winter months in order to take advantage of the snow tote roads and spring freshets, the movement of logs and lumber is seasonal to a far greater degree than it is on the Illinois Central System. The climate and topography in the forest regions traversed by this system are such that lumbering operations can be carried on at all seasons. Therefore, the traffic flow of forest products over the Illinois Central System is practically uniform throughout the year.

Construction Materials

3. Deposits of gravel, sand, stone and clay occur quite generally over the system, and the movements are largely local in character. In 1924 the traffic in these commodities amounted to 6,400,535 tons. The seasonal movement fluctuates with the demand for construction materials. During the summer months the movement in the Northern states shows a marked tendency upward owing to increased construction activity.

Grain and Grain Products

4. The Illinois Central System transported 4,616,345 tons of grain and grain products in 1924. More than three-fourths of the system's 1924 tonnage of grain and grain products originated or was received from connections in the eight Illinois Central states north of the Ohio River, the heaviest movement being from and to points in Illinois. One-third of the corn and wheat and one-sixth of the oats handled by the system were delivered at Chicago. The Illinois Central System surpassed all other railroads in the quantity of corn and all except one in the quantity of oats delivered at the Chicago market. Approximately one-third of all wheat handled by the system was delivered at New Orleans for export.

FIGURE 16.—Loading fresh vegetables on the Illinois Central at a station in Mississippi, to supply the homes of the North where still the ice and snow lie heavy on the fields and gardens.

FIGURE 17.—A cotton compress and storage yard on the Illinois Central System in the great cotton district of Mississippi, in one of the most fertile valleys in the world.

The heaviest movement of corn on the Illinois Central System is in December, January, February and March. Oats reaches it heaviest movement in September and wheat its heaviest movement in August, September or October.

Petroleum and Petroleum Products

5. Petroleum and petroleum products furnished 3,823,308 tons of the traffic moved over the Illinois Central System in 1924. The production of crude petroleum in the territory traversed by the system is comparatively negligible. This traffic reaches the system chiefly from the oil-producing fields of Arkansas, Oklahoma, Louisiana, Kansas and Wyoming through the gateways of Natchez, East St. Louis, Dixon, Ill., Centralia, Ill., Baton Rouge, Memphis, Vicksburg, and Omaha. Sixty-nine per cent of the total tonnage of petroleum products transported by the system originated or was received from connecting lines south of the Ohio River, the heaviest movement being in Louisiana, where 1,631,130 tons were received and 1,495,800 tons were delivered, principally at Baton Rouge. In Illinois 1,085,587 tons were received from refineries and connections, and 1,127,968 tons were delivered.

Fruits and Vegetables

6. The Illinois Central System ranks as one of the leading fruit and vegetable carriers in the country (Fig. 16). Its fruit and vegetable traffic in 1924 amouted to 1,520,794 tons. The principal commodity is bananas, imported through New Orleans, the country's largest banana port, and transported under refrigeration to Chicago, Indianapolis, St. Louis and other distributing and consuming centers in the North. The banana movement continues throughout the year, but is heaviest during May, June and July. The movement of citrus and deciduous fruits from the Pacific Coast, approximating the tonnage of bananas from New Orleans, is almost entirely from Omaha

to Chicago, with the peak movement in September. A considerable part of this tonnage is delivered to connecting lines at Chicago for eastern destinations. The movement of Florida citrus fruits begins in January and extends into May, with the peak falling in February or March.

Another important movement under this classification is that of strawberries from the Southern states. This movement begins in February or March from Louisiana. As the season advances the movement is so timed that a steady flow of fresh Southern berries is being marketed in the North until the Northern crop comes on the market in June or July. The same is true of the Southern vegetable crop, which in recent years has become an important traffic originating along the lines of the Illinois Central System in the South.

Cotton and Cotton Products

7. Of the 1,088,924 tons of cotton, cottonseed and cottonseed products handled by the Illinois Central System in 1924, 57 per cent moved from points in Mississippi, 18 per cent from points in Louisiana and 17 per cent from points in Tennessee. Approximately two-thirds of the cotton movement on the Illinois Central System occurs in September, October, November and December, when the crop is harvested. In 1924 more than one-fifth of the total cotton movement on the Illinois Central System was in November. More than one-third of the system's cotton tonnage moved to New Orleans for export (Fig. 17).

Livestock

8. The Illinois Central System moved 640,838 tons of livestock in 1924. The great livestock-producing states of Iowa and Illinois provided the system with more than three-fourths of its livestock tonnage in 1924. The combined shipments originating or received from connecting lines in the two states mentioned represented 80 per cent of the total system receipts. The principal movement of livestock is to the packing centers of Chicago, East St. Louis, Omaha, Sioux City and Indianapolis. Deliveries in the territory north of the Ohio River represented 91 per cent of the total tonnage handled, and 68 per cent of this tonnage was delivered to points in Illinois. The movement of livestock does not fluctuate to an appreciable extent through the year, although it is slightly heavier during the winter months.

AGRICULTURAL REGIONS OF EUROPE

Olof Jonasson
Economic Geographer, University of Stockholm, Sweden

(*Continued from October*)

CORN AND WHEAT REGION

South of the central wheat, wine, and fruits region with its moderate rainfall, and north of the Mediterranean zone with its dry summer climate, extends a long and rather narrow, but interrupted, "belt" (the corn province) which is relatively important for its production of corn (Fig. 39). As the central European mountains are included as a subregion of the wheat-wine-fruits region, so the corn and wheat region might with considerable propriety also be merged with that region; but because of its larger area and the value of its high agricultural production resulting from the level topography and the deep productive soils, it has been separated as a distinct region. The spurs from the mountain mass of central Europe break this region into several important subregions. These are: (1) Biscay subregion; (2) Lombardy subregion; (3) Hungary subregion; (4) Rumania subregion; (5) Caucasus subregion; and (6) Trans-Caucasus subregion.

As a rule, dairying and swine production increases in importance westwards because of the better market conditions. This is especially true for the upper Po basin with its well-developed manufactures. The dairying of the northwestern portion of the Iberian peninsula represents a typical adjustment to rougher topography and higher precipitation. With the exception of the Rumania subregion the higher yield of corn is characteristic of the best lands. Although

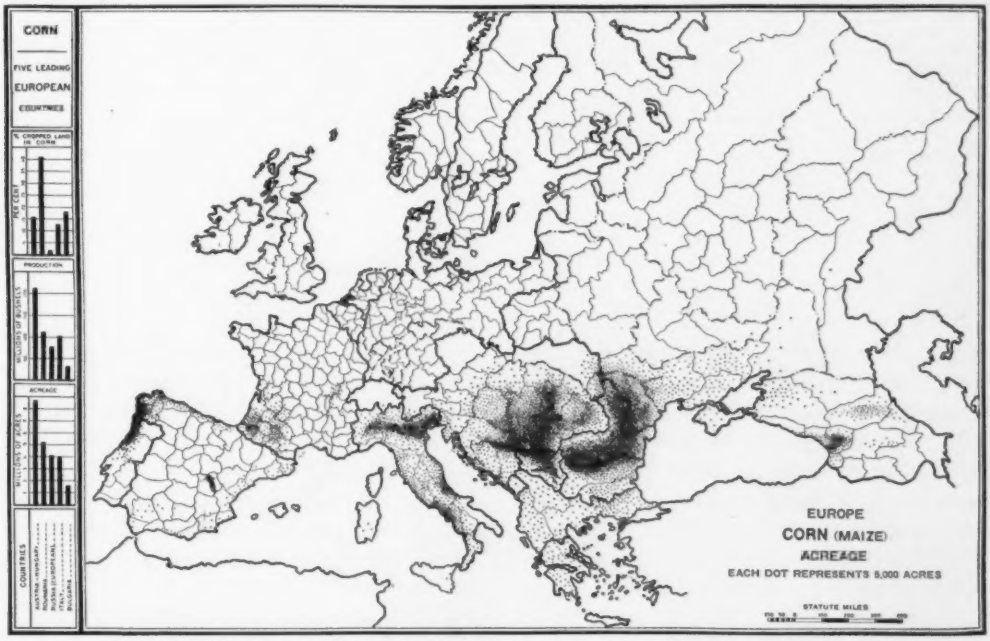

FIGURE 39.—The distribution of corn (maize) in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

wheat is important, it has been crowded out upon the less productive soils of the subregions.

Biscay Subregion

The Biscay subregion consists of the northwestern portion of the Iberian peninsula and southwestern France. It may seem somewhat anomalous that the Spanish portion of the Biscay subregion, coincident with the westernmost extension of the European peninsula where heavy precipitation and low temperatures would naturally be expected, should be a corn-growing region. The explanation lies in that these conditions prevail only during the winter months, while during the growing season the climate is distinctly Mediterranean and yet moist enough for corn. The following figures compare the temperatures of this corn subregion, with those of two stations in the American corn belt, and the rainfall of one typical region in each:

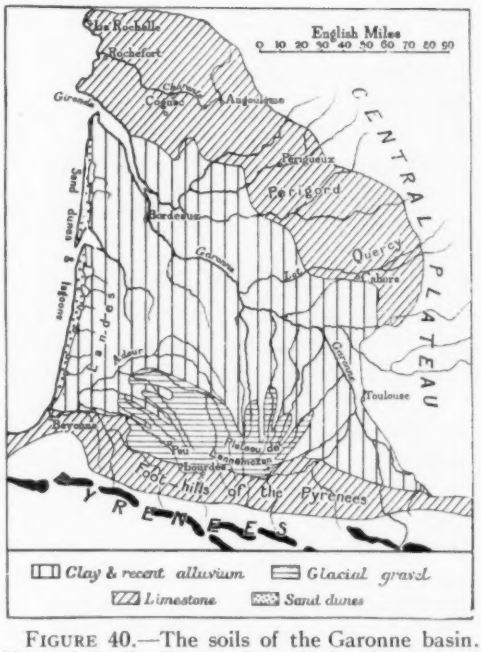

FIGURE 40.—The soils of the Garonne basin. Upon their distribution depends the character of the agriculture.

Corn may be planted in Spain in April without fear of damage by frost. The temperature, highest in August, is about 5 degrees lower for that month than it is in the American corn belt, where it is highest in July. During September the temperature in both sections is practically the same, but in October it is some 2 or 3 degrees higher in the Spanish corn area; for both, May and September have like temperatures; April and October in Spain have temperatures 2 or 3 degrees higher than the American belt whereas in June and August they are 2 or 3 degrees lower. The higher temperature of the American corn belt in midseason is compensated for in Spain by the higher spring and fall temperatures which measurably extend the frost-free season; but the higher temperature—about 5 degrees at the height of the growing season when the stalk is developing and the kernel is filling—in the American corn belt gives it a distinct advantage. Elsewhere in this European region where corn is produced the climate is quite similar to that of the American corn belt, excepting in the wet Trans-Caucasus subregion.

TEMPERATURE (CENTIGRADE SCALE) [16]

Iberian Peninsula:	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*Jun.*	*Jy.*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
Bilbao	8.1	9.7	10.6	12.6	15.0	18.2	20.1	*20.5*	18.8	14.9	11.8	8.8
Oviedo	6.6	8.1	8.5	10.3	12.4	15.4	17.2	*17.4*	16.2	12.3	10.0	7.4
La Coruna	8.7	9.5	10.3	11.8	13.7	16.4	17.5	*17.9*	16.5	13.8	11.4	9.7
Santiago	7.3	8.4	9.4	11.0	13.7	16.8	18.2	*18.9*	16.9	13.1	10.4	8.0
LaGuardia	8.6	10.2	11.5	13.2	15.3	18.5	*19.9*	19.6	18.3	15.1	11.8	9.3
U. S. A. Corn Belt:												
Des Moines	−7.1	−5.5	1.8	10.4	16.4	21.3	*23.9*	22.6	18.0	11.6	2.8	−3.4
Cleveland	−3.3	−2.9	1.2	7.8	14.7	19.9	*22.5*	21.3	17.9	11.7	4.7	−0.5

RAINFALL IN MILLIMETERS

Santiago	197	163	169	135	132	64	52	60	131	150	186	193
Des Moines	29	29	43	77	120	117	92	90	90	65	37	31

[16] J. Hann, "Handbuch der Klimatologie." 1908.

The climate of the northwestern portion of the subregion makes it verdant throughout the year, in sharp contrast to the Mediterranean lands. Dairying prospers; the hills are covered with hardwoods; the lower slopes have orchards of apples and cherries, and groves of chestnuts and walnuts. The corn production is concentrated in the level grasslands where rye, potatoes, flax, and hemp are also typical.

The French portion of the subregion coincides mainly with the basin of the Garonne and the Plateau of the Lannemezan; that is, the southern part of the Lowland of Aquitaine (Fig. 40). The Basin of the Garonne is underlain by a porous limestone which has been covered over with a soft clayey alluvium. South of the Garonne lies a corn producing area of relatively great significance. All along the well-drained terraces of the river valleys, grapes are the chief product. The Plateau of Lannemezan consists of glacial gravels brought down from the Pyrenees by glaciers in times long past and reworked into a great alluvial fan. The soils are infertile except along the many diverging streams where the level-fertile grasslands are now devoted to successful corn production.

The Garonne basin, as the diagram indicates, is covered with clay and recent alluvium over the limestone which underlies the whole of the Lowland of Aquitaine. It is in this alluvial material that corn and wheat are dominant except along the river valleys where the well-drained terraces are more favorable to profitable grape-growing. The Landes, or the lower portions of the basin interior from the sand dunes, has a sandy soil which has been improved for a century and which now grows millet and rye successfully. The deposits of coarse glacial gravel make a dry, infertile soil upon which vegetation grows sparsely. Along the many streams where finer soils have been laid down, meadows and cornfields flourish. The limestone north of the Garonne river forms a terrane of low plateaus and hills interspersed with sheltered and fertile valleys. Wheat fields and orchards share the valley lands with the vineyards.

The uplands are more or less barren because of the porous limestone; those of Quercy are devoted to sheep pastures, whereas those of Perigord are forested with oaks and chestnuts.

The verdant foothills of the Pyrenees on the French side are in sharp contrast to the dry and semi-barren Spanish slopes. The French side has abundant moisture and rather large tracts of fertile alluvial deposits upon which cornfields and vineyards flourish among the picturesque groves of poplar.

Lombardy Subregion

The Po basin or the plain of Lombardy, the classical example of a piedmont plain, is one of the richest and most densely populated sections of Italy and all Europe. It has been filled partly with glacial debris, but in larger part with material eroded and transported from the surrounding mountains by the Po and the Adige and their tributaries; and the rivers have even extended their deltas into the quiet waters of the Adriatic. This alluvial material, rich in plant food materials, has developed into the very productive soil which covers this extensive plain. Rich in organic matter, the soil, though not so dark as the real chernosem, is in striking contrast to the common light-colored soils characteristic of the Mediterranean region as a whole. This fertile soil, stimulated by the bright, almost continuous, sunshine during the growing season, has made of this subregion one of the garden spots of the world. Rice here reaches its northernmost limit for the whole world. Grape-growing is important in this subregion, but the type of vegetation on the plain is determined chiefly by the winter frosts. Trees, intolerant of frost, such as the orange and the olive, can not survive except on the slopes of the Apennines and the Alps. The climate, the natural vegetation, and the agriculture of this narrow belt of mountain slopes, sur-

rounding the real corn and wheat subregion of the plain, are characteristically Mediterranean and have, therefore, been included in this paper with the Mediterranean fruit zone. The bitter winter is brief on the plains however, and the bright sunshine during the long, hot growing season ripens any grain, but the rainfall during the growing season is too scant for crops requiring much water. Consequently corn, which needs more water than the small grains, is grown almost entirely under irrigation. Irrigation is not difficult and thus corn, although not grown so extensively as wheat, is important, and characteristic for the subregion. The lower portion of the section is further characterized by the production of hemp and sugar-beets. Here, also, is most of the grape industry of the plain. The wet meadows of the river banks are ideal for cattle, and cheese-making is an important industry.

Hungary Subregion

The Hungary corn and wheat division consists in the main of the great Hungarian plain, the "Alföld." It is roughly bounded by the Carpathians on the north and the Balkan Highlands on the south, and extends from the Bihar Highlands on the east across the Danube to include the Danube peneplain in the west. Politically, it includes the states of Hungary, and the surrounding sections of Rumania and Jugo-Slavia (Fig. 41).

The Alföld (the plain) was once the floor of an inland sea. It is level except for hills along its borders, and the river trenches. Though not entirely cut off from the beneficent influences of the tempering winds from the Atlantic, this basin frequently has long, hot summers and intensely cold winters. The precipitation average is 20 to 24 inches annually, or about that of central Kansas. The

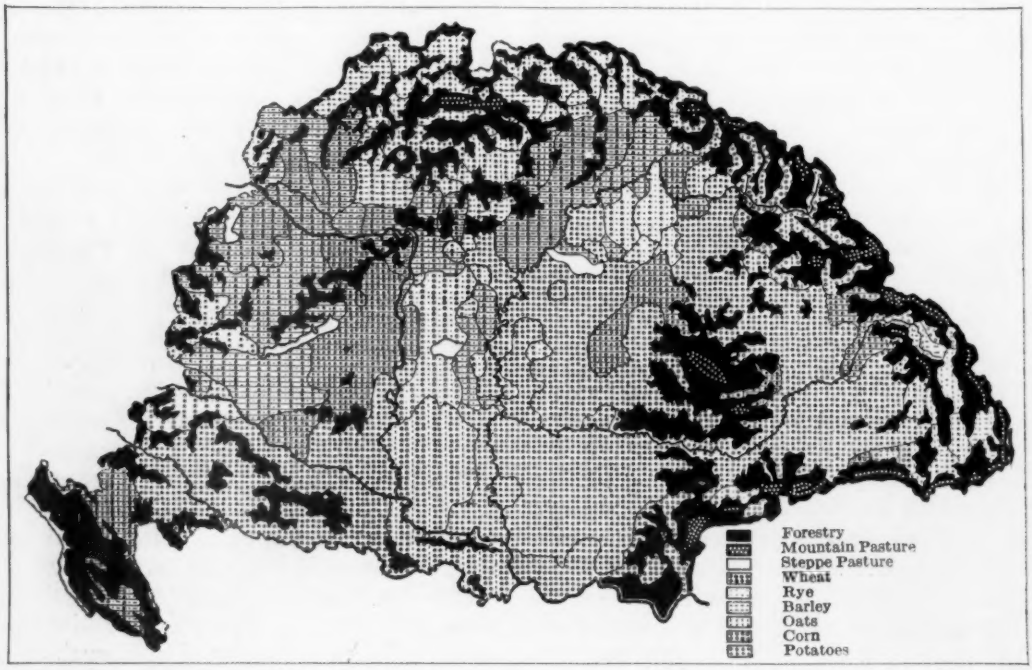

FIGURE 41.—This excellent informative map of Ference Fodor of the University of Budapesth, though all in one color, most clearly indicates the agricultural regions of Hungary and contiguous territory, and the distribution and proportion of the chief crops produced in each. Continuous horizontal lines indicate a well-developed rotation system of agriculture; the absence of these lines an unbalanced grain sequence. Dots of a single crop or of two crops indicate that at least 50% of the area is devoted to them; dots of three crops indicate that at least 70% is devoted to those three crops.

FIGURE 42.—The luncheon hour among the Wallachian peasants gathering their harvest in the valleys about the Marmaros mountains. The Wallachian peasantry, like the Rumanians and the Ruthenians, make corn bread a staple article of food. (From "Ungarn," Stuttgart, 1911.)

FIGURE 43.—Characteristic scenery of the Hungarian Puszta. A vast natural grassland plain, broken here and there by a few trees, by the post and sweep of a well, or by the towers of some distant village. (From "Ungarn," Stuttgart, 1911.)

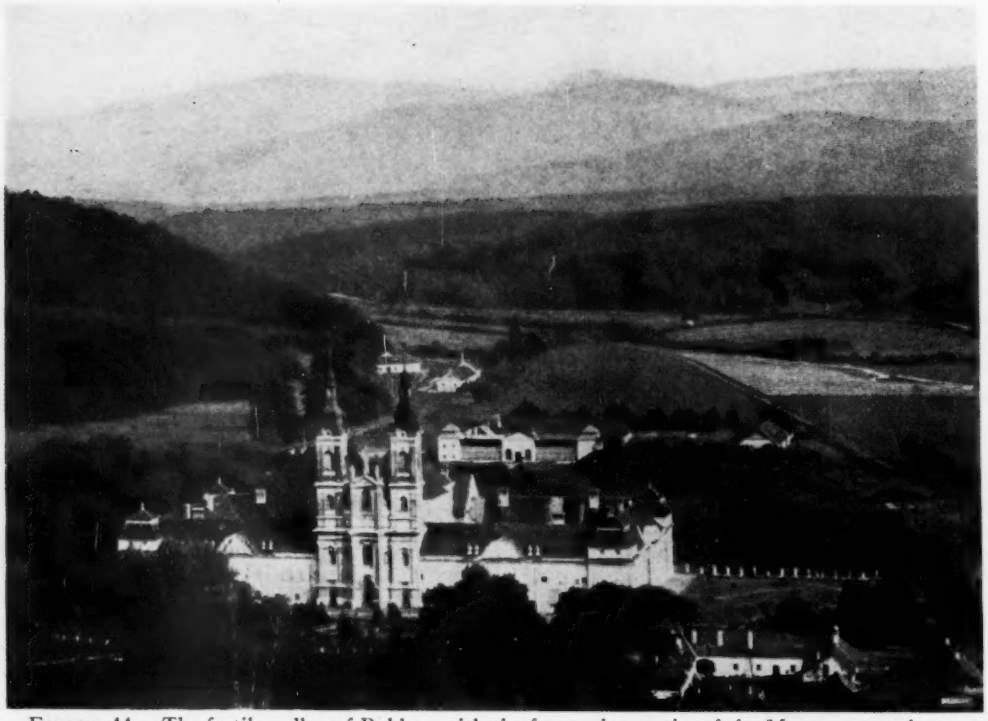

FIGURE 44.—The fertile valley of Boldva, with the forested summits of the Matra mountains, part of the Central Carpathian Cordillera, in the background. The valleys of these mountains are rich in agricultural products, desirable summer resorts, and significant centers of culture, of which the beautiful Jaszovar cathedral in the foreground is a good indication. (From "Ungarn," Stuttgart, 1911.)

central part of the area, where the Körös joins the Tisza, and the precipitation amounts to only 16 to 20 inches, is comparable to western Kansas. Most of the rainfall comes in the summer, with one maximum in June, and another in October. Rainless intervals of 30 to 50 days are not unusual in early spring and

FIGURE 45.—Hogs, fattening on the acorns and other mast of the Bakony forest, are brought down for water to the shore of Balaton Lake by their herder at the close of the day's feeding. In the northern parts of the Balkan peninsula quite a number of hogs are similarly fattened. (From "Ungarn," Stuttgart, 1911.)

it is a well-known fact that nearly all the crop failures in this region during past centuries were caused by droughts which occurred during the early portion of the growing season (Fig. 42).

Irrigation has not been extensively developed. The soils, evolved generally from loess and alluvial deposits, are in the main productive. The alluvial deposits of the Danube, richer in calcium carbonate than those of the Tisza, have developed into a light-black loamy soil with a humus content of about 4 per cent (lower than that of sub-humid grassland soils). Within the areas of lower precipitation a dark brown to black prairie soil with a humus content of 5 to 6 per cent has developed. These soils, derived in the main from loess and not from alluvial deposits, have evolved almost to a chernosem type. Most of the areas of surplus wheat production are located here. On the rougher lands of the surrounding hills and mountain slopes with a heavier rainfall and covered with forest growth the soils are the typical "brown earths" of Ramann.[17] There are also some dune areas of wind-blown sand accumulated in recent historic time, such as "Nyirseg" north of Debreczen, and "Deliblat" in south Banat, at the present time almost stabilized by the planting of pines and locusts. Over 50 per cent of these sand dune areas are now improved and devoted to the production of potatoes and rye in the North and to corn in the South.

The natural vegetation characteristic of the great sub-humid grasslands of the world is very similar here to that of the tall grasses of eastern Europe and western Asia. This is the Hungarian steppe or Puszta. During the last century and even in the last generation much of the Puszta has been broken by the plough and now yields heavy crops, of which wheat is the most characteristic. This change from pastoral industry to crop production resulted mainly from the stimulus of the growing demand for food from the manufacturing regions of west central Europe. Some areas are still found in their natural state, though grazed by cattle and sheep. That such areas should be left natural is not only because of their aridity but also because of the communal character of the land tenure; these areas are not necessarily the driest and sandiest sections (Fig. 43).

The chief corn area is located in the south central portion of the plain, though it is also important eastward where the relief is rougher and the more backward people depend upon corn, their main crop for their chief food. In these hills agriculture is a "hoe" industry (Fig. 44).

Westward in the Little Hungarian plain, a part of the wheat, wine, and fruit region, a higher type of agriculture has developed, with sugar-beets, oats, barley, and potatoes entering into the system of rotation. This plain, located mainly on the northwestern side of the Bakony forest, is a transition area similar to the great dairy region of Europe.

From the point of view of its agriculture and its climate, soil, native vegetation, and topography, the main part of the Alföld is the westernmost extension of the great grain-producing belt which reaches its maximum development in the plains of southern Russia (Fig. 45).

The Transylvania basin, separated from the Alföld by the Bihar Mountains, resembles the eastern and northeastern part of the Hungarian plain with which it is connected at the north. Here corn and wheat occupy at least 50 per cent of the total crop area, justifying the inclusion of the Transylvania basin with the Hungary corn and wheat region. It lies at a fairly high elevation and like the outer portions of the Alföld is maturely dissected into low hills with numerous small basins interspersed among them.

Rumania Subregion

The Rumania corn and wheat subregion is located mainly in the lower Danube Lowland and in the area lying

[17] E. Ramann, "Bodenkunde," 3rd Edition, 1911.

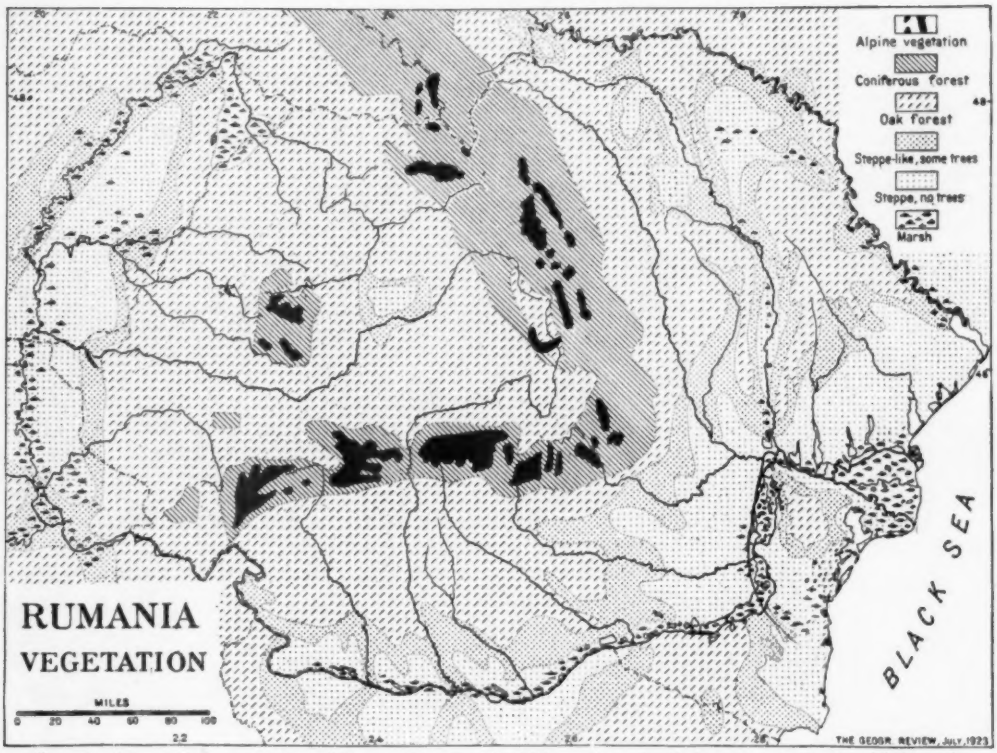

FIGURE 46.—The vegetation of Rumania. In the hilly region of oak forest, corn is the chief product; on the plain, the steppe lands are occupied by wheat; the Danube delta is in places too marshy, in others too arid for crop-growing, and there the land is devoted to pasture, just as in the mountains and rugged foothills. Corn is the staple food of the region; wheat is grown chiefly for export. (G. Murgoci and J. Popa-Burca; in Geografia Romaniei, New Series, 3rd Edition, Bucharest, 1921. Copied from the Geographical Review, 1923, "The New Rumanian State," by E. M. Sanders.)

between the Carpathians and the Black Sea, extending from the Balkan range in the south to the vicinity of the Dniester on the north. The southern part of this basin area projects into Bulgaria. Physiographically the Rumanian plain resembles the Po basin in Italy but the general physical conditions affecting agriculture, as well as the agriculture itself, more closely resemble those of the Hungarian plain. The newly opened lands of the central portion of the plain are almost entirely devoted to the production of wheat for export, the best cash crop for the landed proprietors, for the yield on the virgin grasslands is heavy and of good quality (Figs. 46 and 47).

Corn, the staple food of the people, dominates the agriculture of the plain, however, and of the Balkan foothills bordering it on the south; but in the Carpathian foothills to the west corn though important is not dominant.

FIGURE 47.—Native market scene, Rustchuck, Bulgaria. (Courtesy of Keystone View Co.)

The Balkan district has a more primitive type of agriculture than have the more progressive Rumanian foothills, but both regions are otherwise somewhat similar, —exceedingly fertile valleys nestle among the wooded hills, on which herds of sheep are grazed in the open pastures. Barley, oats, rye, and millet are grown but on a much smaller scale than wheat and corn.

The Rumanian plain with its average annual rainfall of 25 inches is considerably moister than the Danube delta with only 15 inches. With derceasing precipitation eastward and northeastward spring wheat gradually displaces winter wheat, and wherever it ranks first in importance the boundary is fixed between this subregion and the Russian spring-wheat district.

Caucasus and Trans-Caucasus Subregions

These subregions are the most productive corn-growing areas in Russia since Bessarabia became part of Rumania. Corn is the principal crop and the staple food of the people, as in Rumania and Jugo-Slavia. Grapes and tobacco are also produced by the Caucasian races in this subdivision as by the people of the other corn subregions. Since the wheat of these subregions is sown in the fall it is, in this respect, similar to the winter wheat region of Russia to the north.

The Caucasus and Trans-Caucasus subregions, however, are not quite similar. The Caucasus division has developed from a natural steppe land with an annual precipitation of 20 inches or even less, whereas the Trans-Caucasus division is a natural forest-land with 60 inches annual precipitation. The foothills of the latter are mantled with hardwood forests, such as walnuts and oaks: higher up on the slopes, the central Major Mountains subregion, coniferous forests gradually become dominant; the former is a characteristic grassland. In both divisions, the Caucasian portion with its low precipitation and the Trans-Caucasian section with its heavy precipitation, the conditions are not exceptionally suitable for corn or any other kind of grain farming, but grazing is naturally important, and in the Caucasian portion, dominant over agriculture.

HAY AND PASTURE REGION

The hay and pasture region, practically without agriculture, consists of the fiorded districts of the coastward extensions of northwestern Europe—the western part of Norway and the northwestern part of Scotland. To this region belongs also the southwestern coastal area of Iceland already mentioned, where a low type of forest, and pasture for sheep-growing have developed as a consequence of the ameliorating influence of the mild Iceland eddy of the Gulf Drift. Included in this region are also the neighboring similar island groups—the Orkneys, the Hebrides, the Shetlands, and the Faroes (Fig. 48).

This region is characterized by widespread outcrops of complexly folded and faulted crystalline rocks, the oldest in Europe. The surface is rough and broken. The coasts form the typical and best known fiord landscape of the world. On the sedimentary deposits of the valleys most of the agriculture and most of the forests of the region are found.

Scattered remnants of the Cambro-Silurian formations have given rise to fertile soil and relatively level tracts of the best agricultural land of the region. Typical examples are the Jaedren tract in southwestern Norway and the Trondjem tract in west central Norway. The relatively productive agricultural tracts of the northeastern corner of Scotland, and the nearby Orkney Islands are somewhat similar to those of Norway but the underlying sedimentary rocks are Devonian schists.

The climate of this region is not nearly so favorable to grain production as of the hay, dairy, and sheep subregion. The weather is so generally cloudy and cool that of the grains only such hardy crops as oats (tolerant of undue moisture) and six-row barley (tolerant of undue chill)

FIGURE 48.—In the fair and fertile Jordal Valley, a part of Norway's hay and pasture region. (Courtesy of the Keystone View Co.)

can be grown. Consequent upon these conditions hay is the dominant crop of this entire region in which, on the whole, only 2 per cent of the land is improved.

The forest land is generally confined to the valleys. Some forest grows on the slopes of which the most are too barren, or too cold, or too wet, especially on the western sides, for tree growth, but sufficient pasture for sheep and cattle grazing is common. To some extent this grazing is seasonal and while the grasslands of the mountain slopes are the scenes of summer occupation, the small agricultural belt near the sea, the more populous district, shelters the flocks during winter—an excellent example of transhumance due to winter cold, rather than summer drought (Fig. 49).

FIGURE 49.—Milking the goats about a saeter above the Hardanger Fjord of Norway. Cheese made from goats' milk is a rare Norwegian delicacy. (Courtesy of the Keystone View Co.)

The rigorous conditions of this region, its paucity of resources, and its inadequate transportation overland have forced the people to secure their living largely from the sea. While in no other section of the world do the people depend so largely upon the sea as here, crops and grazing are nevertheless more important. In contrast with the niggardly land the sea is liberal in its provision for means of livelihood and sustenance, and the people have become harvesters of the sea. The long extent of coast line, the fishing banks near the mainland, and the warm waters of the North Atlantic Drift with a rich fish fauna, have made sea-farming relatively easy, and markets of the great manufacturing districts of west central Europe have made it profitable.

FIGURE 50.—Laplanders milking their reindeer in the transition zone between the polar coniferous forests and the alpine tundra. (Courtesy of the Keystone View Co.)

POLAR BARLEY REGION

The polar barley region with coniferous forests dominant consists of northern

Scandinavia and northern Russia. With some exceptions—the Silurian plateau of Jämtland, and the coastal valleys (in which clays and sands were deposited when the coast was submerged) about the Gulf of Bothnia in Sweden and Finland—the climate, the topography, and in Åland Islands in the mid-Baltic and at its northern limit, near the Arctic circle, in only 63 days (Figs. 25 and 50).

Approximately 65 per cent of the region is forested; the rest is mostly peat-bogs or other wet lands, with numerous lakes, rivers, and bare rock ledges, with a little

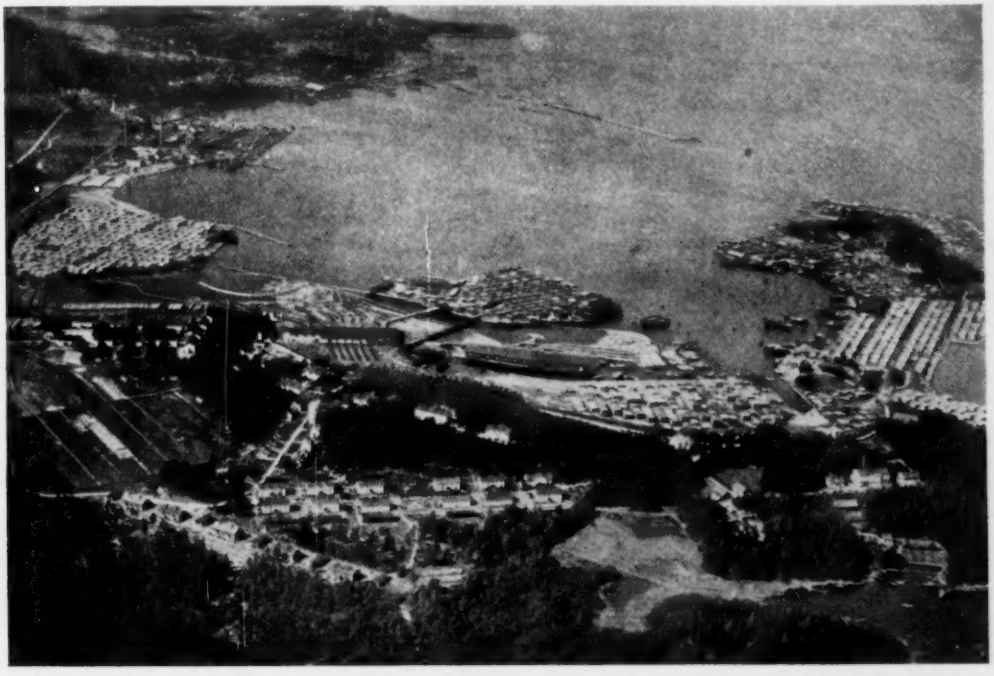

FIGURE 51.—An airplane view of the Skutskär Sawmill. One of the numerous sawmills about the head of the Gulf of Bothnia. These Swedish sawmills, built near the mouths of the streams, are placed as far out in the Gulf as the contour of the coast permits, generally on a projecting cape, or a nearshore island. (From "Industrial Sweden," Stockholm, 1924.)

places the soil of this region are unfavorable to general farming but favorable to coniferous forests. The rather rough topography, very light-colored soils evolved from the morainic materials, and the high percentage of undrained peat-bogs and fens, are all limiting factors in the improvement of the lands; the cool climate and the short growing season are limiting factors in the growth and the yields of winter grains, though the brief period of the growing season is somewhat compensated for by the length of the summer days. As a consequence barley is the dominant crop because it requires only a brief summer season for growth and maturity; it ripens in 116 days on the cultivated land. In Scandinavia about 2 per cent of the region is improved, but in Russia never more than 1 per cent, particularly in the coldest and driest sections in the far northeast sections. Intelligent use [18] of the many well-distrib-

[18] The streams are utilized in a most systematic way. During the closed season of winter the logs are cut and most are piled on the ice. When spring comes on, the streams melt first near the coast and so the logs nearest market come to the mill first; as the streams open up progressively farther inland the logs from successive inland districts come in; finally the freshets from the mountains bring the logs from the smaller, more remote tributaries and the belated cuttings that are put directly into the water.

The cost of transporting the logs by water from the most inland sections is less than a railway haul of but a few miles.

uted streams of steady and adequate volume in floating logs to the sawmills (Fig. 51); modern mills both for lumber and pulp- and paper-manufacture; cheap water power; cheap water transportation; low freight rates as a consequence of short distance to the lumber-importing markets of northwest Europe; and finally high grade softwood forests of great extent and judicious management have developed in Scandinavia one of the most important forest industries in the world.

The boundary between the polar barley region and the oats region is peculiarly significant in that:

(1) It is the northern limit for the profitable or practical growing of wheat (spring wheat);
(2) Likewise it is the northern limit for the growing of winter grain (rye);
(3) North of it barley is the dominant grain crop;
(4) South of it mixed hard- and soft-wood forest replace the pure coniferous forest;
(5) North of it stock-raising is more important than the agriculture, and most of the improved land is devoted to forage crops; the high percentage of fallow lands and natural meadow gradually increases northward of this line; and
(6) North of it, coniferous forest-products afford the principal source of income.

OATS REGION

The oats region, the agricultural belt immediately south of the polar barley region, includes north Jutland in Denmark, most of the southern half of Sweden, the southern half of Finland, all of Esthonia and Latvia, and a belt in Russia extending on either side of the northern railway from the Baltic to the Urals. The dominance of oats in this region is due, primarily, to the relatively cool summer with its late maximum rainfall, just as in west central Europe oats production is favored by similar climate. This region, as well as the other grain regions of Russia, extends across into Siberia; and the southern part of the Urals has been included in this region, because its higher altitude, rougher topography and lighter soils have made oats, barley and potatoes the most important crops. The Urals, however, do not form such a contrast to the region as do the younger major mountains of Europe to their surrounding areas.

Throughout the region the leading grain crop is oats, which occupies about 20 per cent of the total arable land in the Scandinavian portion and about 40 per cent in the Russian portion. Rye is next in importance, occupying 10 per cent of the arable land in the Scandinavian section and nearly as much as oats in the Russian portion. In the Scandinavian district about 40 per cent of the arable land is devoted to forage for dairy, whereas in Russia very little of the improved land is thus used.

The main part of the region is in mixed forest which increases in area eastward and becomes more coniferous in character.

The region has been subdivided into (1) the Scandinavia-Baltic oats, rye and dairy sub-region, and (2) the Russia oats, rye and flax subregion.

Scandinavia-Baltic Oats, Rye, and Dairy Subregion

The Scandinavia-Baltic subregion is a transition belt toward the great dairy region, and the same crops and domestic animals characterize its agriculture; but because of the low percentage of improved land and the correspondingly high percentage of forest land, this subregion could not be included within that great dairy region, though the main part of Denmark, southern Sweden, and the coastal section of Lithuania where improved land forms the larger part of the area, were included. The dairy region, as has been stated, tends to be enlarged at the expense of the oats region, principally because this Scandinavia-Baltic subregion, a natural part of the oats province, is so equally well adapted to dairying and associated industries, that in response to the constantly increasing demand of the neighboring industrial population for their daily food, the more intensive dairying, truck-growing, and swine production tend to become dominant.

Most of the great dairy region with its favorable climate for oats was part of the original oats province before the changes

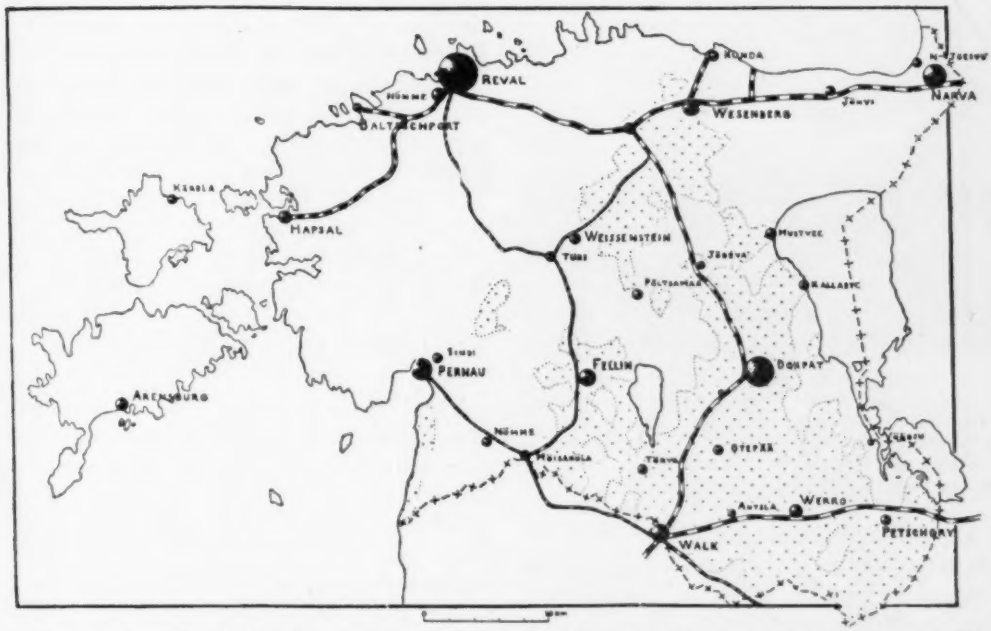

FIGURE 52.—The relation between the larger cities of Esthonia and the agricultural resources. The size of the spheres indicates the relative population of the cities, of which Reval is largest with a population of 125,000. The dotted portion of the map indicates that more than 30% of the land is improved; the blank spaces in the northern and northwestern sections indicate sparse population and more unimproved land, coincident with thin infertile soil, and the distribution of the Cambro-Silurian outcrops. (J. Grufman, in "Estniska republikens geografi," Ymer, Stockholm, 1923.)

wrought by the agricultural revolution; and even yet the production of oats has decreased only relatively, for with the increasing number of horses, dairy cattle, and swine, more oats is grown than ever. This is the reason why the center of oats production in Europe does not lie in the oats region, but in the great dairy region of west central Europe; and similarly why the center in eastern Europe lies in the more highly industrialized, densely populated district of Russia south of the oats region. Thus, the importance of the agricultural system in a region must first be measured in terms of the region itself and then in terms of the rest of Europe. In the polar barley region, for instance, with its limited agriculture and sparse population, barley production is important and characteristic, though from the point of view of all Europe it is insignificant (Figs. 15 and 27).

As a rule the best tillable lands in the Scandinavian part of this subregion in the central Scandinavian plain and those of the polar barley region, coincide with the more or less continuous plains formed during the time of the Pleistocene submergence from glacial clayey materials deposited on the bottom of the sea. From the limestone ground rock of these plains and introduced glacial material a productive silty loam soil has developed. The rest of the subregion is wooded, a hilly country of till, and moraines, and eskers, and kames, and lakes, and bogs, as is most of Fenno-Scandia of which it is a part, and like it, underlain by complex crystalline rocks from which the gray forest soils have developed.

An exception to the coincident distribution of limestones and the best tillable land in this subregion is comprised in the less developed parts of the Swedish [19] and Esthonian Islands and the coastal

[19] The division of the Swedish Islands into two areas is not necessary from the general viewpoint, but because of its interest, and relationships to the Esthonian agricultural-pastoral area, it has been done.

FIGURE 53.—Grazing conditions on Alvaret, on Öland Island, where the soil upon the Cambro-Silurian terrane is too thin for crop-production, as in Esthonia, and on the Edwards plateau of Texas. Horses and sheep are raised. (Courtesy of Du Rietz photos.)

area south of the Gulf of Finland which seem to constitute the remnants of a plain formed by marine erosion.[20] The most nearly similar area of North America is the Edwards Plateau of Texas. Both areas are underlain by Cambro-Silurian rocks, and the precipitation of both is comparatively low. The thin layer of soil in the Edwards Plateau has been interpreted as due in part to wind transportation. It may be that this has been factor also in causing the thin soil in this area in Europe; for at the present time after a period of strong winds there is abundant evidence of the deposits of wind-carried materials which accumulate on the stone walls in the district (Figs. 52 and 53).

[20] H. Hausen, Materialen zur Kenntnis der Pleistozenen Bildungen in den Russischen Ostseeländer. Fennia, Vol. 34, No. 2. Helsigfors.

The Russia Oats, Rye, and Flax Subregion

The Russia oats, rye, and flax subregion is distinguished by flax production. About four-fifths of the world's prewar supply of flax for fiber was grown in this subregion, and its extension into the Baltic states. The high humidity, the moderate rainfall and cloudiness, and the rather cool and uniform summer temperatures of this division, seem to be very favorable to the growing of flax of this type (Fig. 54). This division lies in a belt intermediate between the open grasslands and cereal-producing regions to the south and the forests on the north. The land is

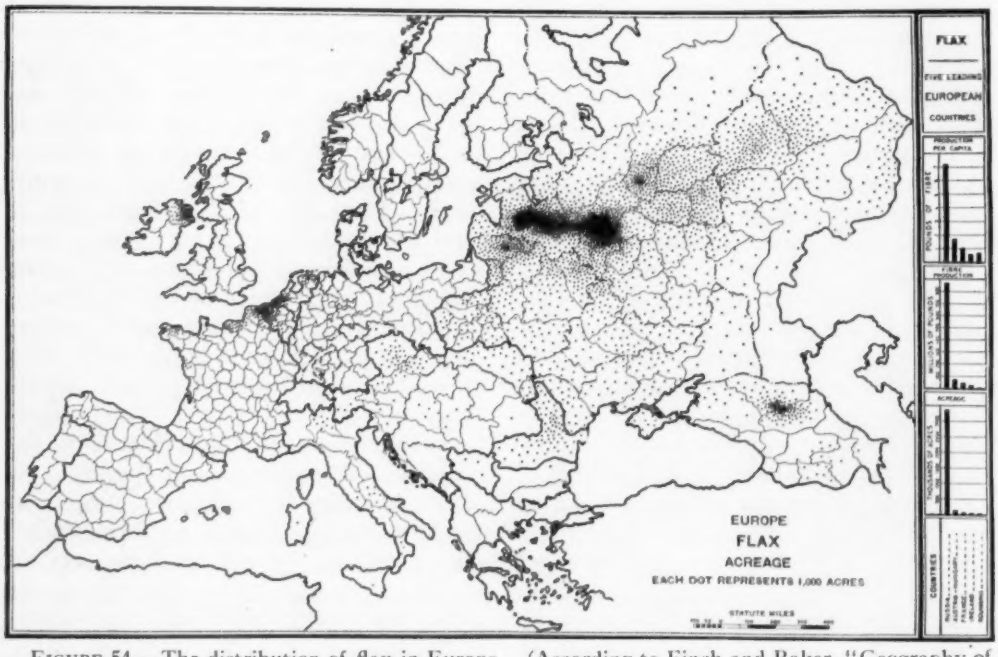

FIGURE 54.—The distribution of flax in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

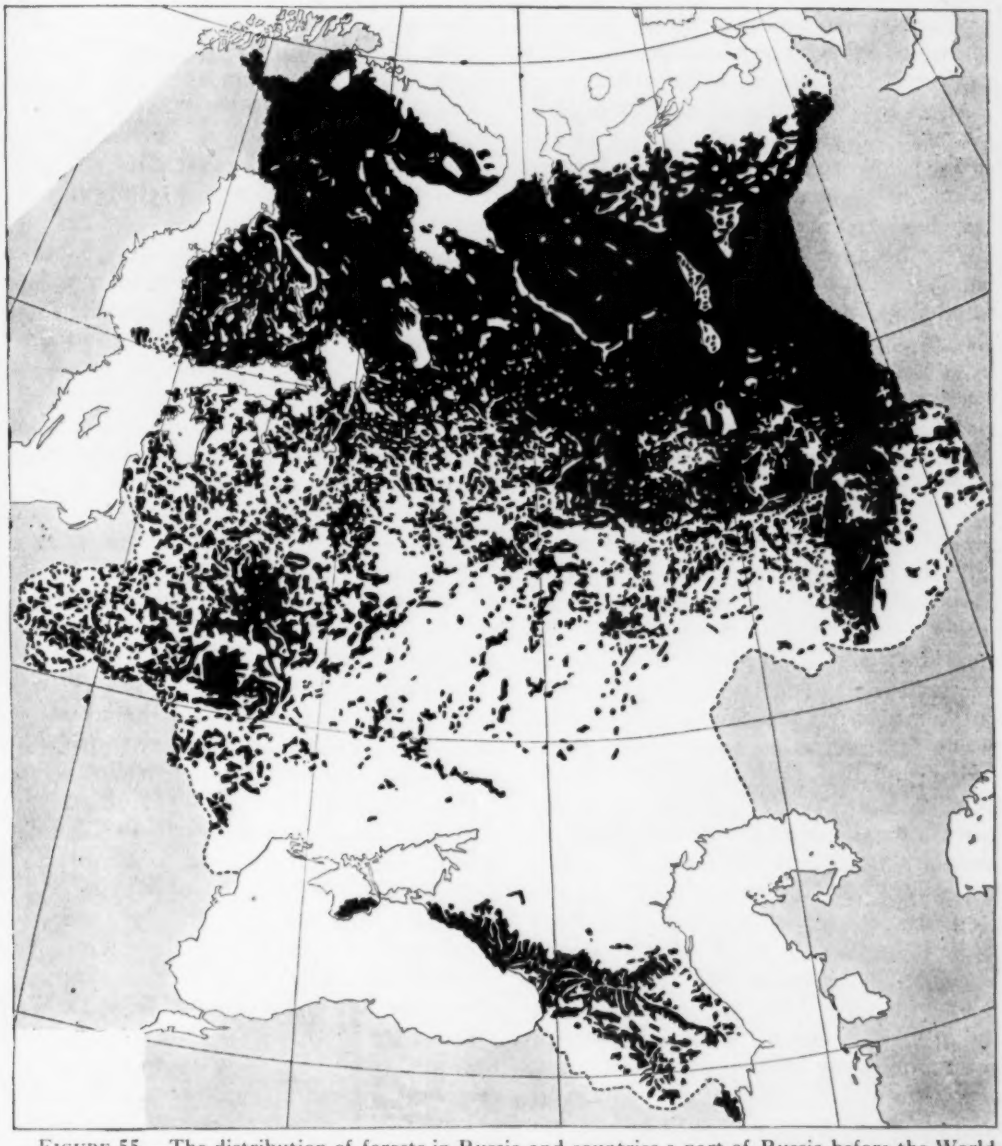

FIGURE 55.—The distribution of forests in Russia and countries a part of Russia before the World War; somewhat over-emphasized in Finland and the middle portion of Russia, even though both deciduous and coniferous forests are mapped. (From "Grande Géographie," Paris, 1914.)

level and somewhat swampy and characterized by a gray forest soil. In general, the crops are grown on soils retentive of moisture and yet well drained.

RYE AND BUCKWHEAT REGION

The rye and buckwheat region includes important hardwood forests. It is located south of the oats region, and because it centers in the southern part of the central Russian plain, its major area is in Russia, with a minor area in the neighboring parts of Poland and the Baltic states. It may be considered an extension of the rye and potato subregion of the great dairy region, and so the description of the physical conditions for that subregion applies. From the viewpoint of the small grains it is a part of the rye province. As a rule, rye is dominant

over oats and occupies about half the improved land of the whole region. Rye production dominates the northern portions of the Black Earth district of Russia, that is, south to the spring wheat region, excepting those sections devoted to the intensive production of the sugar-beet centered about Kiev and Kharkov. Partly because of these exceptions and partly because of the relatively diminished importance of rye throughout the rest of the southern part of this region from the vicinity of the Volga and westward, this section has been differentiated as the sugar-beet and winter grain region; it almost coincides with the western part of the Black Earth district, the exception being that portion of the Black Earth district which lies between the sugar-beet area and the Urals. Along the Urals the spring wheat area extends northward coincident with this northward extension of the Black Earth district. Except for a slight projection southward into the Black Earth district between the sugar-beet and winter grain region, and the spring wheat region, the soils of the rye region are generally infertile, and comprise the ashy-colored timber soils characteristic of northern forest regions. Evidences of glaciation are widespread, but glacial deposits are far less important than in the Baltic sections (Figs. 29 and 55).

The physiographic monotony of the region, like all central Russia, is equaled by the climatic monotony. Long and cold winters, long and hot summers, and brief pleasant spring and autumn seasons are characteristic. In the rye region as in the oats region, the August maximum of rainfall is unfavorable to wheat production but both rye and oats, being more tolerant of greater moisture conditions during the later part of the growing season, are profitably grown. The cold winters, late summer maximum of precipitation, and the relatively unproductive soils, constitute the factors which make the less tolerant spring wheat subordinate to the more tolerant rye with its high resistance to winter rigors, of which "heaving" (the lifting by frost of the young plant out of the soil) and freezing, both due to inadequate snow cover, militate against the growing of winter wheat. This explains why, under normal circumstances, two-thirds of the total production of the world's rye is harvested in this region.

Even in the prewar days when Russia was a great grain-exporting country most of the rye was consumed in Russia. Rye is more a staple food for the Russians than it is for the Teutonic peoples. This may be because of its abundance; or because the Russian people prefer rye bread with its greater capacity to remain fresh and palatable; or because of intangible racial or historical preferences.

In Russia the distribution of buckwheat coincides closely with the extent of the rye region. The relatively unproductive and undrained soils are favorable for its growth. Though the rainfall is ample, the precipitation is not of the marine type so favorable for the growing of the buckwheat in western Europe, especially in Brittany and Normandy. Other factors enter into this Russian region. The northern limit for buckwheat in western Russia is about 55 degrees N., in the vicinity of Memel, and eastward this limit gradually extends northward until at the Urals it is at 57 degrees N. The boundary is rather sharp but not due to change in soil conditions, for in this zone they are rather uniform. It is certainly associated with temperature conditions, especially with the probability of spring frost, to which buckwheat is very sensitive. The southern limit is set in the poorer soils by the decreased rainfall, and in the better soils by the competition of the more profitable sugar-beets, winter wheat, and associated crops.

It is interesting that the intensive production of buckwheat lies just north of the Kiev sugar-beet area, where about 20 per cent of the improved land is devoted to buckwheat. The wet, undrained land here is an extension of the Marshes of Pripet.

Most of the hemp in Russia is produced also in the rye region and practically in the same areas as the buckwheat; and the flax district, which centers in the oats region, extends into this region from the north.

SUGAR-BEET AND WINTER GRAINS REGION

The sugar-beet and winter grains region of Russia has been discussed previously in the treatment of the sugar-beet, wheat, and dairy subregion of the great dairy region of Europe, and in the rye and buckwheat region of Russia. As has been pointed out, this region is practically coincident with the western part of the "black earth"—the Chernosem—district, from the vicinity of the Volga to the Carpathians (Fig. 27).

The distribution of the different crops of the "black earth" district is dependent upon its different physical features. The district has been cut up into a number of distinct plains and low plateaus by the rivers which traverse the area. The western part, in which the sugar-beets are produced, is essentially plateau-like with steep scarps and deep river-trenches. Farther east in the western part of the spring wheat region, the topography is more subdued, and the more steppe-like conditions indicate a transition land between the humid or sub-humid western part and the dry, desert country of western Asia.

SPRING WHEAT REGION

Southward from the sugar-beet and winter grains region, the next agricultural region in Russia is the spring wheat region, with at least 50 per cent of the improved land in wheat, and the unimproved in pasture. The northern limit extends in a general northeast direction from the middle of the Rumanian-Russian boundary to the vicinity of Ekaterinsburg in the Urals. The southern limit, which in a general way parallels the northern limit, extends from Kherson on the Black Sea to Uralsk on the Volga, and thence without a break across the Urals into Siberia. These two boundaries follow

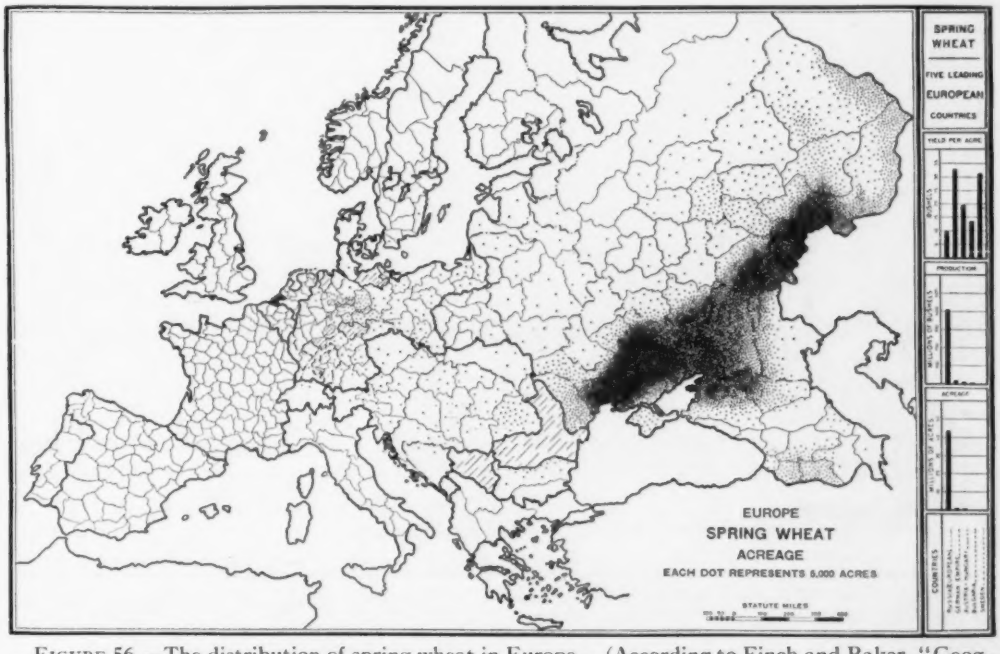

FIGURE 56.—The distribution of spring wheat in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

very closely the annual isohyets of 20 and 15 inches respectively. In its physical characteristics the region resembles the North American spring wheat region which centers in eastern North Dakota and the southeastern section of the prairie provinces of Canada. In both the annual precipitation ranges from 20 to 15 inches, the summer temperatures run from 65 to 70 degrees F., the winters are very cold, the natural vegetation is tall grass, and lime is generally abundant in the soil. Moreover, the soil of the northern portion of the Russian region has been developed into a typical dark chernosem and southward into a chestnut-brown, just as in the eastern section of the North American spring wheat region the chernosem has developed, grading into the chestnut-brown to the westward (Fig. 56).

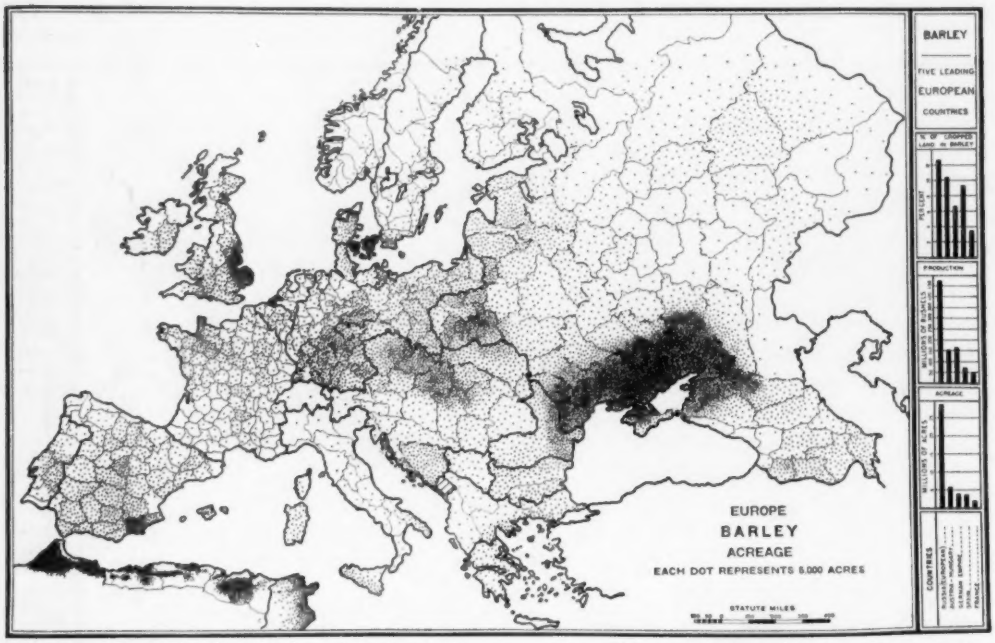

FIGURE 57.—The distribution of barley in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

The severe winters and the lack of snow cover prevent the growing of the winter grains in this region. Of the spring grains wheat grows best and gives the highest yields on the black and chestnut-brown soils. The maximum rainfall occurs in June and July, when the growing wheat can best utilize it. The climate and soil conditions are evidently primary physical factors for an interpretation of the great production of wheat in this region,—120,000,000 quintals or almost 500,000,000 bushels, under prewar conditions, the largest in the world. The improvement of this land is, of course, very closely related to the increased demand for food from the great manufacturing countries of industrial Europe. It was not until the middle of the 19th century that the greater part of the region was put into cultivation, and even though Russia centuries [21] prior to this time was a comparatively large exporter of wheat, in modern times it was not until then, the middle of the 19th century, that wheat began to be exported

[21] In ancient times there was export of grain from the Scythian plains to the grain deficient countries of Greece, and later Rome. See E. C. Semple, Geographic Factors in the Ancient Mediterranean Grain Trade. Annals of the Association of American Geographers, Vol. XI.

FIGURE 58.—A Russian peasant plowing his field with a primitive plow in the subtropical barley region of the southern part of the chocolate-brown soil belt. (Courtesy of the Keystone View Co.)

from the favorably located ports on the Black Sea.

Flax is grown for oil in the spring wheat region of Russia just as it is in the spring wheat region of North America.

SUBTROPICAL BARLEY REGION

The subtropical barley region of Russia is a transitional section between the spring wheat region and the agriculturally undeveloped steppe region bordering the Caspian Sea. Though most of the barley in Russia is grown in the lands near the spring wheat region it is only in the barley regions, where it occupies 50 per cent or more of the cultivated land, that it is dominant over wheat. As the percentage of improved land decreases toward the natural short grasslands there is a relative, if not an absolute, increase in the land adapted to pasture. This is owing chiefly to the progressive decrease in precipitation to less than 15 inches annually, and the increasing evaporation. The soil has developed into a chestnut-brown type with patches of alkali; and the type of natural vegetation is short grass (Fig. 57).

Even though there is some agriculture in the steppe regions where conditions are locally favorable, the southern limit of the subtropical barley region indicates here, as it does throughout the world, the extreme limit toward the dry deserts; barley [22] thus becomes the indicator for the limit of small grain production toward both the cold desert death zone, and the dry desert death zone. Likewise since barley is comparatively less profitable than the other small grains, the areas of chief production will be

[22] These statements do not hold for the two-row barley, as has been brought out in the discussion of the two-row barley and dairy subregion.

pushed toward those sections where climate is unfavorable to the growth of the other small grains (Fig. 58).

Considered on the basis of the small grains, this region is similar to the semi-arid barley, wheat, olives, and pasture region of the Mediterranean, but it is more level and its climate, soil, and natural vegetation are more characteristic of the semi-desert. Through the subtropical barley regions of Asia Minor and north Africa this region merges into the semi-arid barley, wheat, olives, and pasture region.

THE MEDITERRANEAN FRUIT ZONE

The Mediterranean fruit zone is a striking contrast to the small grains zone. The subtropical, or Mediterranean fruit, zone consists of the Iberian Peninsula, excepting the Pyrenees and the Iberian portion of the Biscay corn subregion; the lower portion of the Rhone basin; all of Italy, excepting the Lombardy corn subregion; and the Balkan peninsula, excepting the northern interior portions. In a general way, this zone, with its special characteristics, surrounds the whole Mediterranean Sea.

The physical conditions of the Mediterranean fruit zone are almost totally different from those found elsewhere. Climate, topography, soils, and natural vegetation, and consequent upon these interrelated factors, the types of land utilization, are all different from those of the other zones of the earth, and warrant definite treatment.

Climate

The climate of the Mediterranean has three primary characteristics:

(1) Being a transitional type and moving north and south with the heat equator, it is a desert climate during the summer, and a semi-maritime climate like that of west central Europe during the winter. Consequently rain falls in the winter months, while the summer months are a period of drought. The distribution of the rainfall is indicated in detail in the following map from Philippson.[23] The southeastern parts of the three major peninsulas of the Mediterranean region, dessicated by drying winds, resemble somewhat the semi-arid or barley region (Fig. 59).

(2) The winters are not only moist but also mild (during the coldest month the mean temperature is about 40 degrees F.), owing to the beneficent influence of the sea and the protection of the bordering mountains. Summer is hot and dry with an average July temperature exceeding 70 degrees F.

(3) Bright sunny skies—almost cloudless in summer and far less cloudy even in winter than the skies of northern Europe—are an essential element in the Mediterranean climate. The hot, sunshiny weather is ideal for the ripening of the fruits so characteristic of this region. It is also important in curing, preserving and shipping many of the fruits and their products.

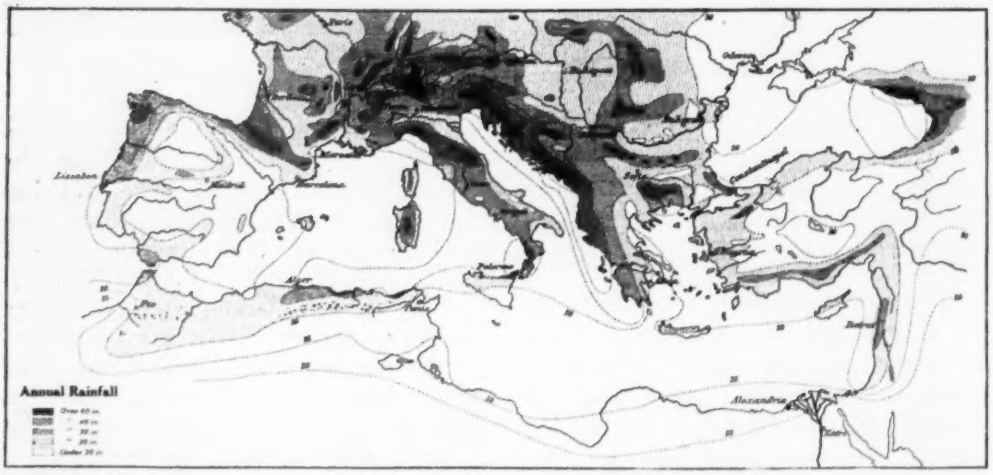

FIGURE 59.—The distribution of annual rainfall in the Mediterranean Section. The southeast corners of the three peninsulas have the lowest rainfall. (From "Das Mittelmeergebiet" by A. Philippson.)

[23] A. Philippson. "Das Mittelmeergebeit," Leipzig, 1904.

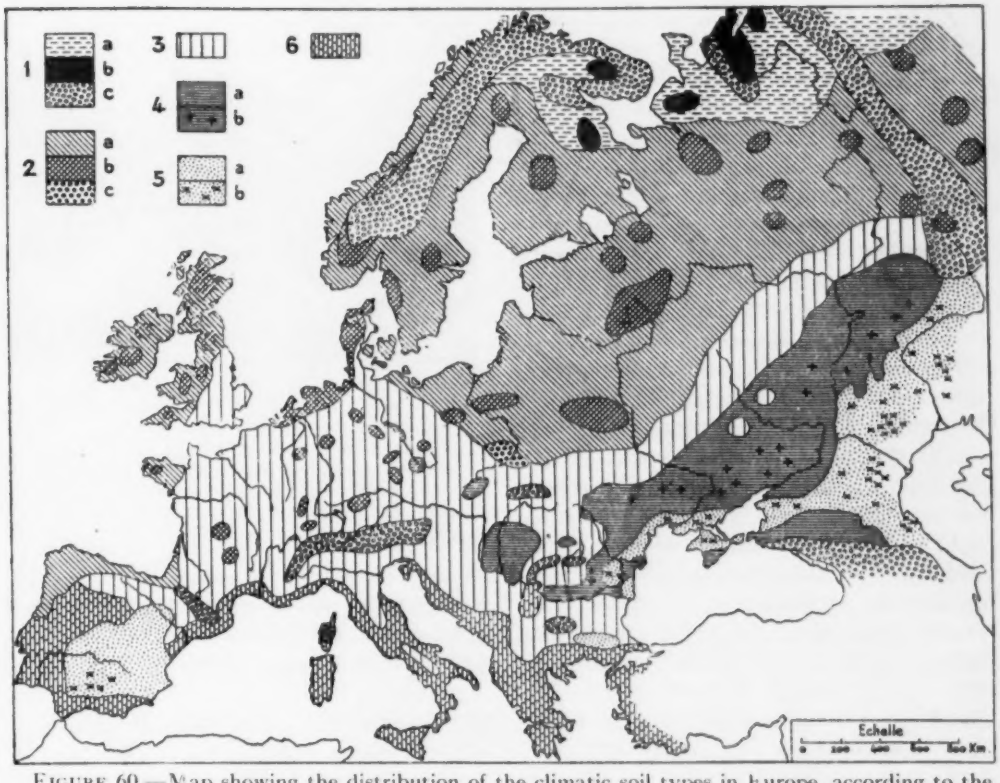

FIGURE 60.—Map showing the distribution of the climatic soil types in Europe, according to the zonal classification, and particularly from Sibirtzev and Ramann.

1. Soils of the Tundra: a. Clayey and sandy tundra; b. Peat-bogs; c. Stony land.
2. Podsolized soils, the very light-colored forest soils: a. Podsols proper; b. Waste-land and peat-bogs; c. Rendzinas.
3. Brown forest soils and degraded chernosem.
4. Chernosem soils: a. Chernosem proper; b. Saline soils.
5. Chestnut-brown steppe soils: a. Chestnut-brown soils; b. Saline soils.
6. Soils of the Mediterranean region.

The distribution of the climatic soil groups here presented is very much generalized, but shows, however, some close correspondences between Mediterranean soils like the "terra rossa" and Mediterranean fruit zone, for example; between the chestnut-brown soils and the semi-arid barley, wheat, olives, and pasture region of the Mediterranean and the Russian subtropical barley region, both of which are agriculturally also similar; between certain soils of northwestern Europe and the hay, dairy and sheep subregion of the great dairy region; and between the chernosems and the spring wheat region.

Topography

The land mass of the Mediterranean region has been much modified by geologically recent mountain-making activity, and the deeper depressions formed have been filled by the sea; consequently the region presents a remarkable variety in its land forms; peninsulas and islands, mountains and valleys, small plains, piedmont slopes, with level surfaces and high plateaus. The interior mountain masses with high plateaus like the Meseta of Spain, the narrow coastal belts like western Italy, and southeastern Greece, and a few broad lowlands like the plains of Thessaly and of Andalusia, have played an historic part in the evolution of modern society.

Soils

The soils of the Mediterranean region are highly varied and localized (Fig. 60). In a recent publication, C. F. Marbut [24] thus describes them:

[24] C. F. Marbut. Annals of the Association of American Geographers. Vol. XV, No. 1, pp. 20–21.

"The Mediterranean region belongs geographically to the belt in which these soils (dark grassland soils) lie, but owing to recent geologic changes a region which pedologically is a part of south Russia and west Siberia was broken up into a number of small areas, some of which retain the characteristics normal to the geographic belt in which they lie and others have become essentially equivalent in soil character to western Europe.

"Mountain building forces have raised many areas into climatic zones entirely different from the normal of the belt. Vulcanism has covered large areas with easily disintegrated basic rocks or unconsolidated accumulations with chemical and mineralogic characteristics identical with the indurated volcanic rocks, and the prevailing topography has promoted the widespread occurrence of young unleached soils by the rapid rejuvenation of the soil through erosion of any leached surface horizon. The ever present soil movement on slopes has prevented the formation of soil profiles unfavorable to plant growth.

FIGURE 61.—The Mediterranean mountain area is now forested only in small part, and erosion consequent upon denudation has carried away the soils to such an extent, that even were it not too rough, crops could not be grown,—except locally where deposition rather than erosion is active,—and the land instead of reverting to forest becomes sparse, or inferior, pasture.

FIGURE 62.—A typical Dalmatian coastal landscape, the mountains crowding the cities upon the narrow strips of lowland. Heavy rainfall permits a more luxuriant plant growth than is characteristic of the Mediterranean region. (From "Vegetationsbilder" by G. Karsten and H. Schenck, Jena, 1910.)

"The northern shores of the Black Sea, the Plains of Thessaly, Thrace, and Macedonia, considerable areas in Asia Minor and Syria, Sicily, and northern Africa, all of which retain the soil characteristics normal to the belt in which they lie, soils equivalent to those of south central Russia and western Siberia, were able to supply sufficient grain for the support of the cities of Greece and Rome, aided by grain from irrigated Egypt."

The soils of the lowlands including the river valleys are mainly composed of, or derived from, alluvial materials, but where they are formed from unconsolidated volcanic materials they are most permanently and intensely fertile, and in the palmy days of Greece and Rome constituted veritable granaries. The slopes are in general so subject to erosion that soil materials do not accumulate on the surface; instead the subsoil is here exposed, and in typical areas underlain by limestones, this reddish subsoil has given the characteristic term, *terra rossa*, to the soils of such areas. Soils of some of the uplands, as of Tuscany, are derived from volcanic tuff, but the typical soils of the high plateaus, developed under a light rainfall (in the drier parts less than 20 inches), are the characteristic brown steppe-type. These latter are found particularly in the east central portion of Spain.

Natural Vegetation

The vegetation of the Mediterranean is evergreen, and following Schimper's lead the ecologists have termed it a sclerophyllous woodland. The common, characteristic shrubs of the region which make up the so-called "maquis" flora are *Olea europea* (olive-tree), *Ilex aquifolium*, *Laurus nobilis* (bay-tree), *Myrtus communis* (myrtle), *Pistacia lentiscus*, oaks and citrus trees of several species, and the *Phrygana*. Some conifers, though not characteristic of the "maquis," such as *Cupressus horizontalis* (cypress), *Pinus halepensis* (Aleppo pine) and *Pinus pinea* (stone pine) are common. These typical plants are characteristic for the lower plains and coastal lands of the Mediterranean lands. At higher altitudes, as above an elevation of about 600 m., where the temperature is lower and the rainfall more adequate, and the soil has not all been eroded, the vegetation develops into a type characteristically similar to that of central Europe. Higher than this frosts are frequent, and the vegetation more nearly resembles that of northern Europe (Fig. 62).

Very few forests remain in the Mediterranean fruit zone despite its original wooded character. As the lands have been brought under cultivation and as the timber has been removed, erosion, particularly by water, has been so accentuated that the loose surface materials have been removed over large areas on the slopes and mountains (Fig. 61). The close grazing by numbers of sheep and goats, and the hot drying summer, have accelerated the erosion still further, until the rougher lands are now almost bare of soil and timber, and fit only for grazing.

Because the land utilization of a district is so closely related to the physical conditions, it is to be expected that in consequence of the general characteristics of the Mediterranean region thus briefly described, it would be divided first into an interior mountain and plateau portion and a coastal lowland portion; and then each of these into a humid or subhumid portion and an arid or semi-arid portion. Such division would result in four regions; but the coastal semi-arid section is relatively so small and in its intensive agricultural development so dependent on irrigation that it has not been distinguished as a separate region. Consequently the Mediterranean fruit zone is subdivided into one semi-arid region, and one humid or sub-humid region, which in turn comprises a coastal subregion and an interior subregion.

HUMID OR SUB-HUMID WHEAT AND MEDITERRANEAN FRUIT REGION

The humid or sub-humid wheat and Mediterranean fruit region which comprises the main part of the Mediterranean fruit zone in Europe is characterized by

the typical conditions of the zone. Wheat and barley are important crops. It is significant that rye is found only on the infertile land, as on the western plateau of Old Castile. Oats-growing is also very limited in this region, the one exception being in the relatively dry part of southeastern Italy where, as in the American cotton belt, it is probable that oats are sown in winter and cut green for forage. It is notable that potatoes, likewise unimportant in the Mediterranean fruit zone, have a similar concentration to that of oats in Italy. Forage and root crops so characteristic of the great west central European dairy region are almost absent and the number of dairy cows is almost negligible, a reflection of the physical conditions as well as the lack of manufacturing and large concentrations of non-agricultural people. In addition to wheat, barley, and the various Mediterranean fruits and vegetables, sheep, goats, mules, asses, and the European buffalo are distinctive for this division as well as for the whole Mediterranean.

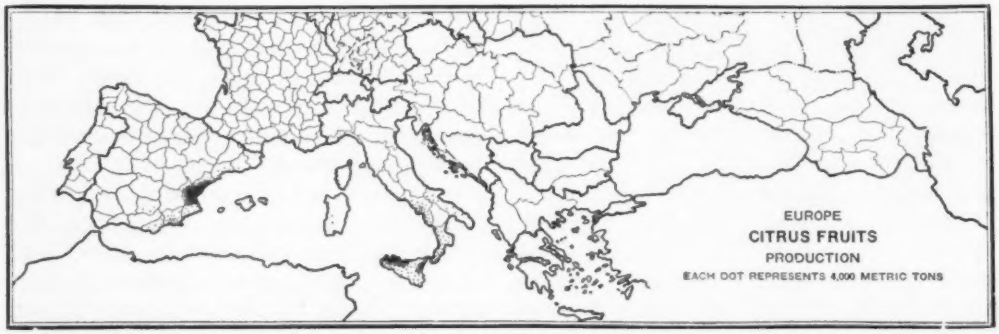

FIGURE 63.—The distribution of citrus fruits in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

Wheat and the little corn which is grown constitute the staple food cereals for the Mediterranean peoples. Barley is used mainly as forage to feed horses, thus replacing the oats so used in central and north Europe. Very little barley is used for brewing beer. The southern Mediterranean fruits comprise the citrus

FIGURE 64.—Andalusian transport in the sunny Mediterranean littoral of southern Spain. (Courtesy of the Keystone View Co.)

FIGURE 65.—Shepherds and their flocks on the Argive Plain of Greece—but none with a golden fleece! (Courtesy of the Keystone View Co.)

FIGURE 66.—The distribution of olives in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

fruits, olives, and nuts of different kinds. Grapes are grown everywhere, and the making of wine is an important and widespread industry. Figs, dates, and cotton, and even sugar-cane and bananas, can be grown in certain favorable localities but they are not important.

FIGURE 67.—The southeastern portion of the Iberian peninsula belongs to the semi-arid barley, wheat, olives and pasture region. That it is the driest part of the peninsula is indicated by its soils and vegetation. It is the largest irrigated district of Europe. (The map is a reprint from Isaiah Bowman's "The New World," New York, 1921. The boundary between the arid and humid regions is from J. Brunhes in "La Géographie humaine," Paris, 1917. The limits of the steppe areas are from E. Rayes Prosper, "Las estepas de Espana y su vegetation," 1915.)

Humid Coastal Citrus, Wine, and Wheat Subregion

The humid coastal citrus, wine, and wheat subregion includes the coastal areas and lowlands where the rainfall is adequate and as a rule more than 20 inches a year. The other physical conditions are here also most advantageous, with the result that this region is very densely populated. It contains about two-thirds of the population of the Mediterranean fruit zone. It affords great variations in density of population from the sparsely-populated semi-arid or rough and cut-over tracts, to densely populated non-irrigated grain-producing areas and irrigated river basins (Figs. 63 and 64).

Sub-humid Interior Wheat and Pasture Subregion

This is the interior mountains division. At present the country presents a rugged

FIGURE 68.—Treading out the grain on a small coastal plain of Greece. (Courtesy of Keystone View Co.)

FIGURE 69.—Date palms in Alicante, the most tropical expression of the Mediterranean region in Europe. (From "Vegetationsbilder" by G. Karsten and H. Schenck, Jena, 1910.)

pastoral landscape, with scattered agriculture on the high plateaus, especially in the Iberian peninsula, where the surface is more level, the soil deeper and more productive. On the deeper fertile soils cereals, particularly wheat, are grown successfully in spite of the relatively low precipitation (about 20 inches) and the relatively high evaporation: but even here most of the land is in pasture, in part because of its original steppe character, and in part because of the denudation of the plant cover and the consequently accentuated erosion of the soil. In the Old Castilian area, the greatest of the high plateaus, agriculture, however, yields the chief income of the people (Fig. 65).

SEMI-ARID BARLEY, WHEAT, OLIVES, AND PASTURE REGION

This region occupies the driest parts of the Mediterranean fruit zone, including the southeastern portions of the peninsulas, and the Balearic Islands, Sardinia, southeastern Sicily, Crete and Euboea. It extends into north Africa, western Asia, and southern Russia where it gradually merges into the Russian subtropical barley region. The annual rainfall throughout the region is less than 20 inches (Figs. 66 and 67).

In the Balkan section the region includes only coastal lands with some interior lowlands, which from early historic times have been of relatively great significance as grain-producing areas. This fertility is due in part to the origin of the soils from volcanic materials (Fig. 68).

The Italian section of the region is drier than that of Greece, and approaches pasture land. The section in Spain has the largest area, and in parts is the driest in the region. Although irrigation is common throughout the Mediterranean fruit zone, it is in this Spanish section that it is most significant. As a result the population is concentrated in large oasis-like settlements in the midst of uninhabited or sparsely-populated wastes. The smaller river valleys are gardens of fertility isolated by ridges that are practically barren. Every Mediterranean fruit and grain grows here, and as the semi-arid soils are rich in the so-called plant food materials, two or three crops can be grown each year on the same land.

The irrigation in this section, as in the rest of Spain, was begun by the Moors. They built long canals and aqueducts of such fine workmanship that they are still used. In Valencia and Murcia, the famous citrus-growing areas of Spain, such irrigated tracts are significantly called huertas, that is, gardens (Fig. 69).

Most of the areas in this section are characterized by a continuous covering of esparto grass; and where the drought is more severe, vast tracts become true steppes similar to those of the steppe region of Russia. In these steppe areas the soils have an exceptionally high saline content, probably in part because of the gypsum in the parent rock from which the soils are derived; hence many of the common plants in such areas are salt-tolerant plants, or halophytes.

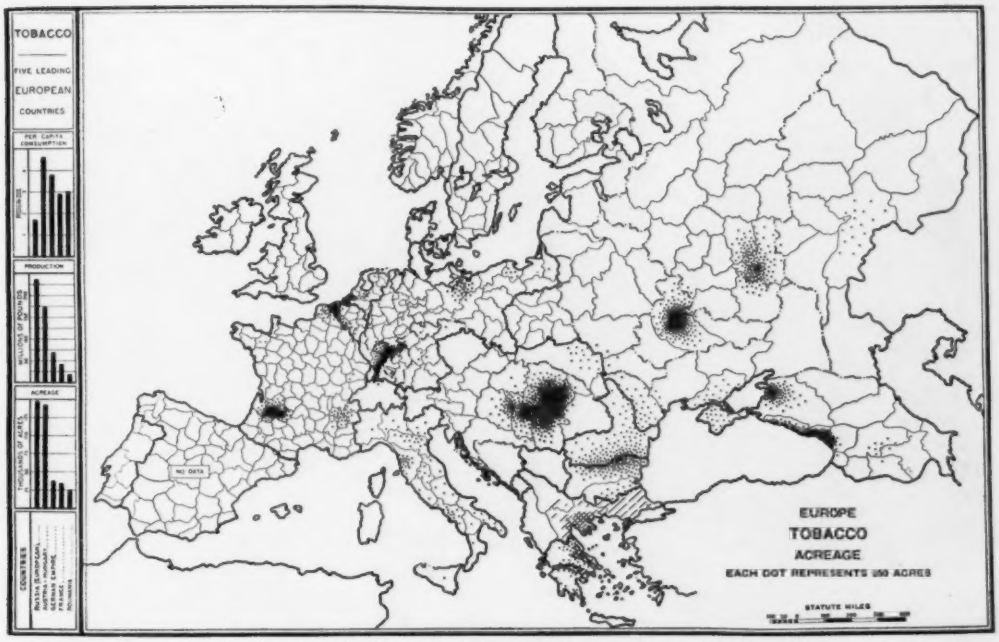

FIGURE 70.—The distribution of tobacco in Europe. (According to Finch and Baker, "Geography of the World's Agriculture," U. S. Dept. of Agriculture, 1917.)

DRY TRANSITION ZONE

The dry transition zone in Europe is almost without crop production except where irrigation has made possible intensive utilization of the arid land. It constitutes only a minor extension of the Asian transition zone, so great and so distinctly Asiatic. The southernmost portion is so dry that for the purposes of this article it has been detached from the zone as a whole and made part of the subtropical death zone. The remainder of the transition zone is designated the "steppe region" in which agriculture is negligible.

STEPPE REGION

In this steppe region with negligible agriculture the precipitation, less than 10 inches, is not ample for general crop production, but some sheep, cattle and horses are grazed upon the bunch-grass vegetation that characterizes it, not wholly unlike the bunch-grass of the American West. The region further resembles the Great Basin of western United States in its light-colored soils, with patches of high alkali content, and its scattered tracts of halophytic vegetation. The alkali is due not only to the hot, dry climate and imperfect drainage, but to residuum from the evaporation of interior pools and lakes without outlets, and the remnants of the Caspian Sea in its former greater extension. Salt pools, and salt deposits from old salt lakes now vanished have been utilized for salt production.

DRY DESERT DEATH ZONE

This, the most arid part of Europe, lies immediately north of the Caspian Sea, and like the other Russian regions continues into Siberia. Agriculturally it is distinguished as the desert region.

DESERT REGION

The desert region is characterized by such extreme physical conditions, and such sparse vegetation that only a most limited number of sheep, cattle and horses may range seasonally over it, migrating to other pastures when neces-

FIGURE 71.—Drying the hay crop artificially by electrical power in the moist marine climate of Sussex, England, so favorable for grass growth but so unfavorable for curing hay. (Courtesy of Underwood and Underwood.)

sity demands. When the herds move, practically all the widely-scattered nomadic Mongoloid population, Kirghiz and others must follow, except for the few engaged in salt-making, fishing, or trade along the Volga; this migration constitutes one of the most dramatic seasonal movements of a large mass of people.

SUMMARY

Because of the fortunate combination of physical conditions, the best agricultural lands in Europe appear to be coincident in a general way with the five subdivisions of the sugar-beet and wheat region, and the six subdivisions of the corn and wheat region. (See map of the small grains.) The middle of the first region extends roughly along the 50th parallel from the English Channel to the Volga river, and the middle of the second region roughly along the 45th parallel from the Atlantic Ocean to the Caspian Sea. When demand for food arises, the most profitable crops have the first choice of those lands which have the best physical conditions suited to such crops. Hence the relatively high yielding sugar-beets and wheat are characteristic of the first region, and wheat and corn (which produces about twice as much per acre in weight as wheat) are typical for the second region. Corn is limited because of climatic reasons to the second region. In both regions wheat is grown in rotation with the associated crops, of which sugar-beets are most intensive in regard to labor and capital applied as well as to the value of the product. It is also interesting that tobacco, though of relatively low acreage, yet one of the most intensive crops grown anywhere, is concentrated in these two regions (Fig. 70).

The surrounding regions are occupied by crops which are less profitable and by crops adapted to less suitable physical

conditions from the general agricultural point of view. Thus from the region occupied by the sugar-beets to the cold desert or "death" zone there follow in succession the rye region, the two-row barley region, the oats region, and finally the polar barley region, or in the western section the hay and pasture region; with a corresponding succession of constantly less favorable conditions for agriculture, and lower grade of land utilization except in the two-row barley region which a more fertile soil makes superior to the rye region, and almost as excellent as the sugar-beet and wheat region. From the dry desert or "death" zone toward the corn and wheat region there follow successively the suptropical barley region and the subtropical or Mediterranean wheat region. The division lying between the two best agricultural regions of Europe is a region with more or less concentrated wheat production which westward is the winter wheat territory and eastward the spring wheat territory.

Likewise, in those regions where certain crops or groups of crops are domi-

THE AGRICULTURAL REGIONS OF EUROPE
MILES
0 250 500
KILOMETERS
0 400 800
O.J.N.
COLD DESERT DEATH ZONE
1. TUNDRA REGION
TRANSITION ZONE
2. CONIFEROUS REGION, NO AGRIC.
A. POLAR CONIFEROUS SUB-R.
B. ALPINE CONIFEROUS SUB-R.
TEMPERATE, OR SMALL GRAINS, ZONE
3. DAIRY, HAY, AND ROOT-CROP R.
A. HAY, DAIRY, AND SHEEP SUB-R.
B. TWO-ROW BARLEY AND DAIRY SUB-R.
C. SUGAR-BEET, WHEAT, DAIRY SUB-R.
D. SMALL GRAINS, DAIRY, TREE-FRUIT S.
E. RYE, POTATO, DAIRY SUB-R.
4. CENTRAL WHEAT, WINE, FRUIT R.
A. HILLY UPLANDS SUB-R.
B. MAJOR-MOUNTAINS SUB-R.
5. CORN AND WHEAT REGION
A. BISCAY SUB-R.
B. LOMBARDY SUB-R.
C. HUNGARY SUB-R.
D. RUMANIA SUB-R.
E. CAUCASUS SUB-R.
F. TRANS-CAUCASUS SUB-R.
6. HAY AND PASTURE REGION.
7. POLAR BARLEY REGION.
8. OATS REGION
A. SCAND-BALT. OATS, RYE, DAIRY SUB-R.
B. RUSSIAN OATS RYE FLAX SUB-R.
9. RYE AND BUCKWHEAT REGION
10. SUGAR-BEET AND WINTER-GRAINS R.
11. SPRING-WHEAT REGION
12. SUBTROPICAL BARLEY REGION
SUBTROPICAL, OR MEDITER. FRUIT, ZONE
13. HUMID AND SUB-HUMID WHEAT AND MEDITER. FRUIT REGION
A. HUMID OR COASTAL, CITRUS FRUIT, WINE, WHEAT SUB-R.
B. SUB-HUMID OR INTERIOR, WHEAT AND PASTURE SUB-R.
14. SEMI-ARID BARLEY, WHEAT, OLIVES, PASTURE, OR SUBT. BARLEY
TRANSITION ZONE
15. STEPPE REGION
DRY DESERT DEATH ZONE
16. DESERT REGION

FIGURE 72.—Summary Map of the Agricultural Regions of Europe.

nant, such dominance represents adjustments to physical conditions modified by economic forces, and there also are found the extreme physical limits for the growing of the various plants. From the north the succession of the extreme physical crop limits are as follows: six-row barley, oats, rye, wheat, sugar-beets, and corn, or exactly the same succession as for the different regions from north to south. All these limits lie within the polar barley region or the oats region. Northward from the dry desert the corresponding succession is barley, wheat, and corn.

In spite of the great variation in physical conditions and the different tariff policies of the several European countries attempting to operate more or less as independent units, these small grain regions of Europe are rather distinct. Because, however, of the rapid changes which have taken place in European agriculture consequent upon the industrial revolution of the last century, and which have resulted in trends from one-sided grain production to wider variety of crop production with systematic systems of rotation, the grain provinces are not so characteristic for west central Europe in our day (Fig. 71). Instead a system of agriculture is being evolved which is characterized by production of perishable and ponderous commodities near their consumption centers; by great yields of dairy products, vegetables and fruits; by intensive potato growing; by specialized rotation systems; by high land values; by highly developed plant and animal-breeding; all of which result in the highest possible yield per acre, the highest possible yield per cultivated plant, and the highest production per domestic animal, that the millions of industrial workers shall not be malnourished or hungry; that they shall live well and happily as they produce from the raw materials of the world the thousands of comforts and conveniences for the needs of its teeming millions.

THE PRESENT ECONOMIC CONDITION OF GERMANY

Bruno F. A. Dietrich
Economic Geographer, University of Breslau

ECONOMIC conditions in Germany today present such a rapidly changing picture that it is possible to give a review only for the moment; and yet a very deep impression may be made by even such an ephemeral picture. The rapid changes are merely an index to the stages of readjustment to diminished territory and economic loss consequent upon the World War and the consequent peace (Fig. 1).

These losses of territory and resources must at the very outset be considered an established fact, a background for the kaleidoscopic changes that have since taken place, and for the picture of present economic conditions. The whole situation in Germany today reflects the effort to make the restricted geographic resources of the country meet the demands of a population that has almost regained its pre-war number despite the loss of 10 per cent of her population, and 13 per cent of her land as a result of the war, as the accompanying table indicates.

TABLE I

Germany	*Sq. Mi.*	*Pop. 1910*	*Density 1910*	*Pop. 1914*	*Density 1914*	*Pop. 1925*	*Density 1925*
Pre-War Area.....	209,000	65 Mill.	311	67.8 Mill.	324	....	....
Post-War Area.....	183,000	58.5 Mill.	319	....	....	65 Mill.	355

On the basis of its present area the density of population in Germany in 1910 would have been 319 inhabitants to the square mile. Today it is 355 inhabitants to the square mile, the densest in the history of the country, for the population has now attained to 65,000,000, the 1914 figure, on its much smaller area.

How significant this fundamental fact of denser population has become, may readily be appreciated when it is recalled that since the middle of the nineteenth century, fifty years before the war, the population has surpassed the food possibilities of the land, and has had to depend upon alien sources for a considerable part of its aliment,—17 per cent at the outbreak of the war. Ever since the beginning of industrialism the German people have imported part of their food (Fig. 2); and with its rapid development, throughout the later half of the nineteenth century and the first decade and a half of the twentieth, the importation increased constantly, notwithstanding the intensification of agriculture over the whole land. Improvement of farming technique, extension of cultivated area, more effective utilization of every acre of ground, increased use of fertilizer, development of dairying, every known method of increasing production,—all were insufficient to make the land sustain the burden placed upon it, and Germany changed from a dominantly agricultural country to a highly industrialized country, with a population increasingly dependent upon imported food-stuffs.

Two solutions to the problem of feeding her sixty-five millions of people are possible to Germany: (1) to import food; (2) to make the home land bear the whole burden. The first solution would make Germany dependent upon foreign supplies, and destroy her "autarkie," its self sufficiency, now nearly achieved, even though prior to the war 17 per cent of the population were fed from abroad. The second way seems wellnigh impossible, considering the efficient utilization of the land to its utmost capacity now. To solve her problem Germany must first determine which, if any, of her

resources are capable of greater extension and production, and then bring them to their maximum efficiency as quickly as possible. These possibilities will be taken up in turn as follows: (1) Increase in land cultivated; (2) improvement of land already in use; (3) intensification of land use; (4) improvement of waterways; (5) increased utilization of bituminous and lignitic coals, and potash; (6) extended development of water power; and (7) augmented efficiency of labor.

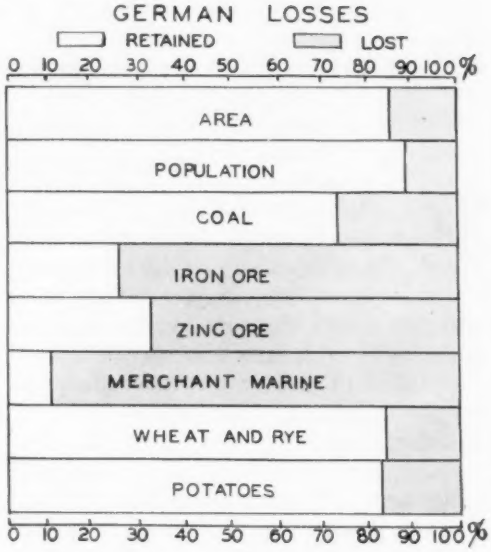

FIGURE 1.—Germany has ingeniously adapted her diminished resources to the post-war needs of her population.

INCREASE IN LAND CULTIVATED

If Germany were willing to exhaust her forest resources as fast as the United States is doing at present until her forests occupied but 4 per cent of her total area, as do England's forests, she could readily transform large areas now forest to crop and pasture lands; but by so doing she would destroy that excellent

INDUSTRIAL TERRITORIES AND WATER POWER TERRITORIES

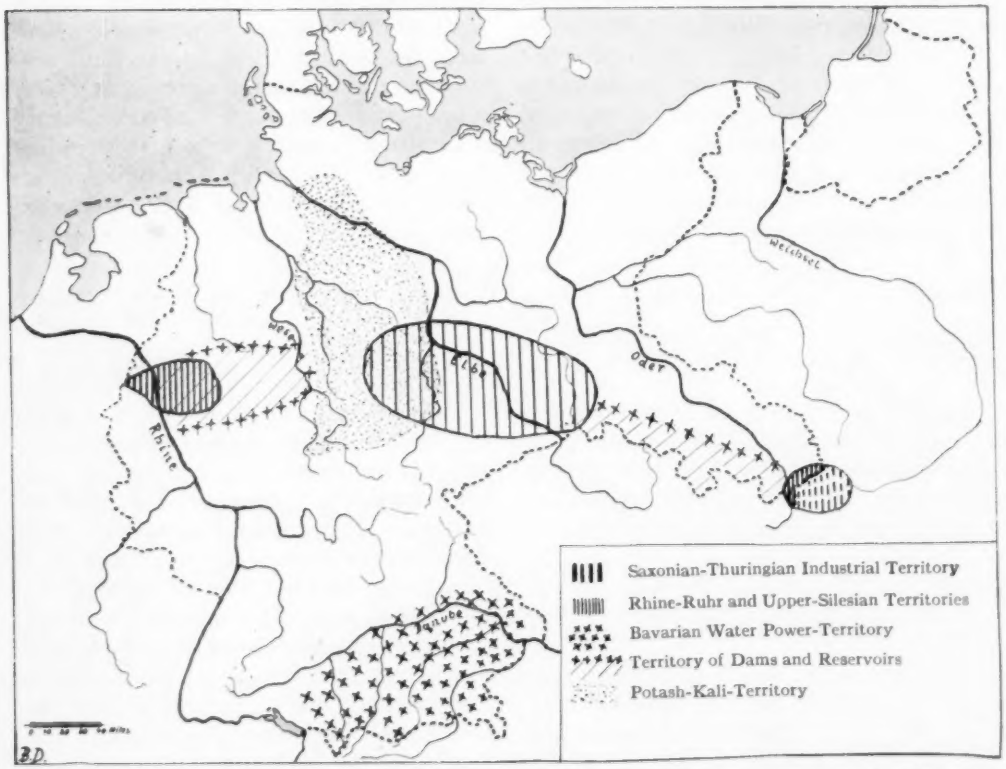

FIGURE 2.—Germany's regions of high industrialization and modern water power development; their relation to the agricultural regions are particularly significant in the light of Germany's desire and necessity for self-sufficiency.

balance between her agriculture and lumber industry which experience has shown to be the best for her welfare and prosperity in the past, and injure the present economic adjustment between the two industries, and others dependent upon them. At present only 9 per cent of the total area of Germany is waste, devoted neither to agriculture nor forestry; 21 per cent is in forests and copse; and 64 per cent is given over to agricultural purposes. Fifty per cent of the total area is in crops of grain, legumes, and roots (potatoes, turnips, beets, etc.), fruit gardens, orchards, vineyards, and other intensive forms of land use.

Six per cent of Germany's soil is marsh and moor, which may possibly be reclaimed for drainage and soil improvement. This has already been extensively begun. The land is drained; the poor soil is dug up and thoroughly mixed with better soil brought in from more favored sections; buckwheat is then grown for a few years until the soil conditions permit the growth of wheat and other small grains.

Some heath wastes may be reclaimed. On the Lüneburg heath of northwestern Germany, the hard thin stratum of "Ortstein" some six inches beneath the surface, which prevents the movement of the soil water, has been broken up by steel plows, and the resultant ground successfully planted in crops. An even more interesting reclamation project has been the arduous recovery of extensive lowlands along the north coast by dikes along the sea, with laterals extending seaward like a lattice work.

IMPROVEMENT OF LAND ALREADY IN USE

Extending the area or crop production would not alone suffice to provide the German people the food they need. It is necessary to increase the productivity of every acre to its uttermost power. This has been done largely by the use of the vast stores of potash with which middle Germany has been blessed, to an extent not considered before the war. Since the war these potash salts have been applied wherever the soil has not achieved the maximum yield permitted by the relief and climate, with the consequence that the chemical industries associated with fertilizer manufacture have been highly developed, and the agriculture highly intensified. When the chemistry works now under construction are in full operation, Germany will have a supply of mineral fertilizer quite adequate to her needs, an annual production as follows:

Nitrogenous salts from the gas works	100,000	tons
"Lime" nitrogenous salts	120,000	"
Habersalz	300,000	"
Total nitrogenous fertilizer	520,000	"

to which must be added the 3 per cent bituminous production and the 5 per cent coke production utilized to provide the following potash and phosphates:

Total nitrogenous fertilizer	520,000	tons
Total potash salts	1,000,000	"
Total phosphates	300,000	"
Total mineral fertilizers	1,820,000	"

INTENSIFICATION OF LAND USE

A comparison of Germany with the United States in the intensity of its land use reveals not only the difference in yield but the difference in relative area of the various grades of land utilization. Germany must devote her every plot of ground upon which agriculture is possible to the most intensive use to which it is adapted, whereas the United States possesses comparatively large expanses of territory devoted to the lower grades of utilization, upon which the agriculture may be intensified not only to support a larger population with high standards of living, but to produce an exportable surplus of raw materials for the trade of the world. To crop production Germany is devoting every acre physically fit for that use, and making it yield the highest returns of which it is physically capable.

Stock raising in Germany's scheme of agriculture and political economy is subordinate only to crop production. Increased breeding of improved and

specialized strains characterizes post-war agriculture in Germany—one type of cattle for beef in the lowlands, another for milk and cheese in the highlands, are the broadest example of this tendency.

Specialization of soil utilization also characterizes post-war agriculture to an extent unknown before the war. The crops are carefully selected for the soils upon which they thrive best and produce most. Winter wheat is characteristic in the western part of Germany, spring wheat in the eastern, spelts in the southern, and chiefly rye and oats in the northern. Beets are grown on the glacial boulder clay of central Germany along the Elbe River, and in the provinces of Posen and Silesia, the districts where the beet sugar industry of Germany, now the greatest in the world, had its origin.

The nice adaptation to soil and climate, application of the most scientific technique and equipment, and innate Teutonic thrift, industry, and persistence, have combined to make German post-war agriculture wellnigh sufficient to the needs of the people. The way to this achievement has been hard and wearisome indeed, for the war and its consequences almost paralyzed the industry—whole provinces were lost, labor was decimated and exhausted, and the standard of currency was so debased that not until 1924 was the financial crisis overcome; but now agriculture has quite recovered, and with the initiation of new schools of agriculture in every province, and the establishment of agricultural departments in many universities, and model farms and experiment stations, a new era of prosperity seems inaugurated.

IMPROVEMENT OF WATERWAYS

With the exception of the Danube, all the important German rivers—the Rhine, the Weser, the Elbe, the Oder, and the Vistula—flow north or northwest. With the exception of the Rhine which heads in the Alps, all have their sources in the mountains of middle Germany, and so connect the center of the land with its coastal periphery, the south with the north.

Most untoward, and unfortunate for the national and economic interest of Germany, is the fact that the Rhine estuary is in Netherlands, not within the limits of Germany. As the iron ore industry developed, and all the industries dependent upon it, a German outlet for the Rhine became increasingly necessary, and finally the Rhine-Ruhr-Ems Canal was dug from the Lower Rhine to an outlet upon the North Sea, wholly German. Now most of the exports, chiefly of the iron industry, reach the high seas through the Ems River.

The potash industry finds its outlet to the North Sea by the Weser River; the Saxonian-Thuringian industrial district by the Elbe River, through its great port, Hamburg; the Silesian district attains the Baltic Sea by the Oder River, through Stettin harbor; the "Polish Corridor" gives Poland an outlet to the world's commerce by the Vistula River, through the port of Danzig,—like the "Corridor" formerly German territory.

To make east-west waterways (Fig. 3), Germany had to connect her south-to-north rivers by a network of canals; some of these, dug two hundred years ago, were not adapted to modern transportation, and for the passage of the great river-tugs with capacity of 1,000 tons of 1,000 metric hundredweight each, had to be straightened and deepened.

In the last twenty years, a number of secondary canals have been dug in northwest Germany; two very great canals have been completed, one connecting Berlin, the German capital and metropolis, with the lower Oder River and Stettin harbor, and another, the Midland Canal, joining Berlin and the Elbe with the Rhine-Ruhr district; and a third great canal now under progress to unite the Weser and the Danube. The Berlin-Oder canal was built under the greatest engineering handicaps through greatly diversified and unindurated terrane largely glacial; part of the canal even passes over the railways

(Fig. 4). The Berlin-Elbe-Rhine-Ruhr connection—the Midland Canal—now completed almost to the Elbe at Magdeburg, is intended to bring the metal products from the industrial districts of the Ruhr and Silesia into easy exchange with the products of the agricultural sections and to be the first strand in a whole network of lowland waterways to facilitate this exchange. A series of other canals joins the Ems, the Weser, the Elbe, and the Baltic, and projects for other canals to connect the Rhine and the Danube by the Neckar route, and the Elbe and the Oder south of Berlin are under consideration.

Water transportation is so much cheaper than rail transportation that estuarine harbors tend to monopolize trade and grow rapidly; and inland ports have sprung up that are "heads of navigation" for the big river tugs, among which Duisburg-Ruhrort, Mannheim, Berlin, and Hamburg are most important. Next to the Duluth-Superior harbor in the United States, Duisburg-Ruhrort is the largest inland port in the world.

The only serious drawback to the development of the German river navigation is the internationalization of the rivers by the Versailles Treaty which tended to make German sovereignty over them incomplete, and title to them merely nominal, a drawback made even more serious by the free ports established along their courses for Poland and Czecho-Slovakia, neither of which contributes to the cost of construction or maintenance.

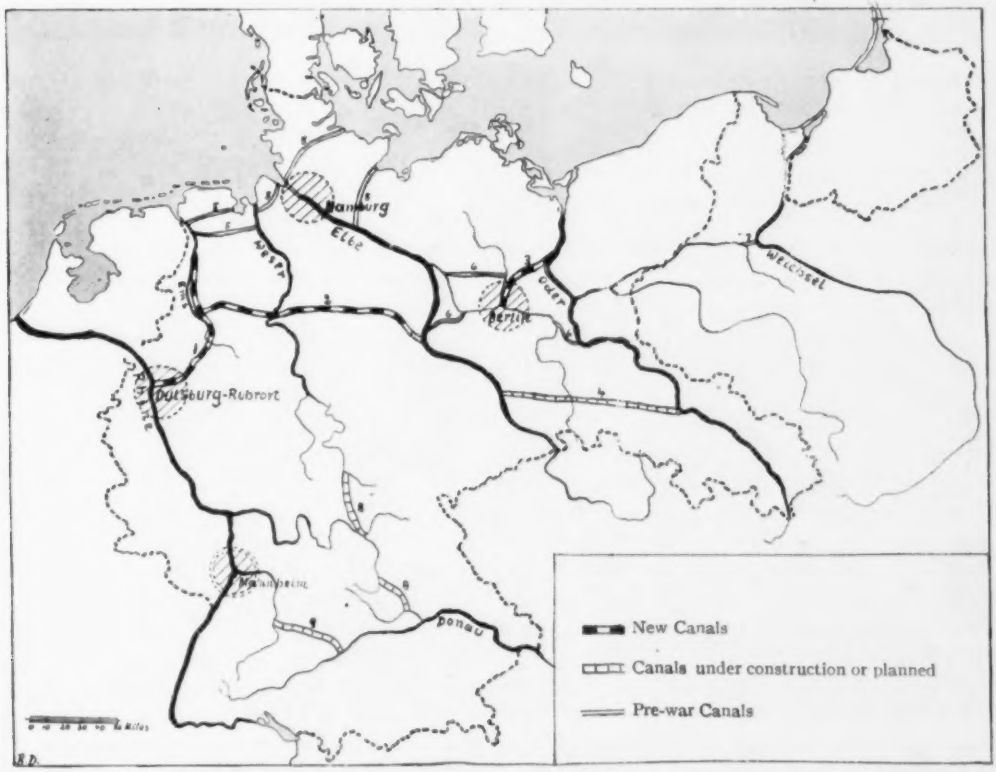

FIGURE 3.—The east-west system of canals connecting the north-south systems of rivers, is an important factor in the cheap transportation of German goods, both raw materials and finished products. The canal system now only in its incipiency will be greatly extended. The shaded circles indicate the larger inland harbors. The canals are as follows: 1. Rhine-Ems Canal; 2. Midland Canal; 3. Berlin-Stettin Canal; 4. Elbe-Oder Canal; 5. Northwest Canal System; 6. Pre-war Elbe-Oder Canal System; 7. Oder-Weichsel Canal; 8. Weser Danube Canal; 9. Rhine-Danube Canal.

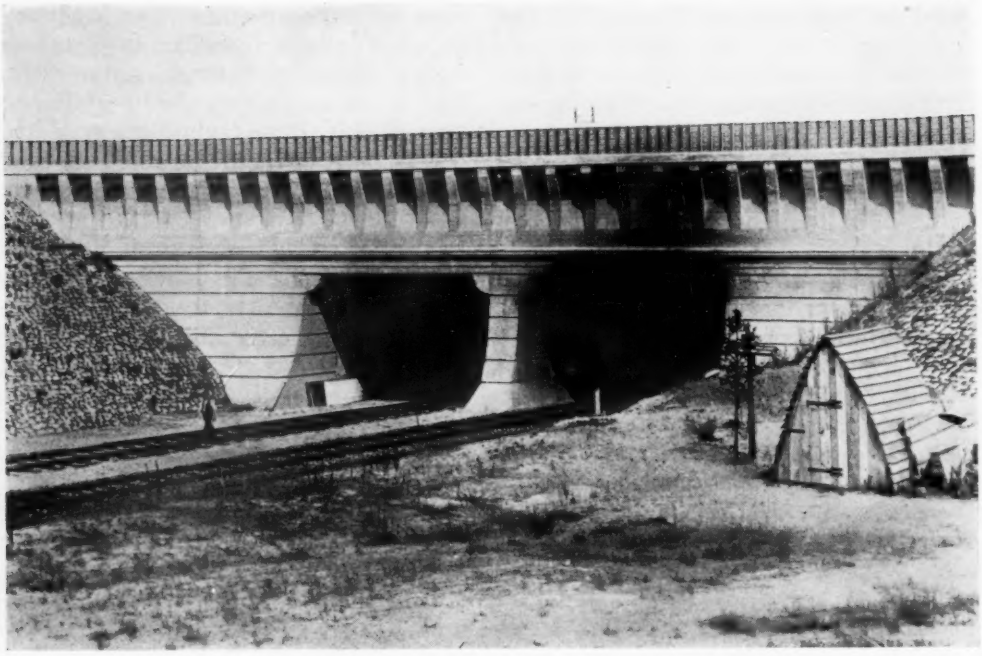

FIGURE 4.—The aqueduct bearing the Berlin-Stettin Canal over the railway near Eberswalde, one of the achievements of German engineering.

INCREASED UTILIZATION OF BITUMINOUS AND LIGNITIC COALS, AND POTASH

Next to the resources of the soil, Germany's wealth and strength must come from her coal, iron, zinc, and potash, invaluable resources to such a highly industrialized economic organization as hers.

The coal fields of pre-war Germany yielded more than one-half the coal of Europe. Her iron mines furnished more than a fourth of the iron. The fortuitous proximity of these two resources constituted the basic advantage for Germany's rapid industrialization and her quick rise to prominence in the seven seas and in the marts of the world.

The distribution of Germany's mineral resources in a belt from the eastern to the western frontier coincides in general with its middle mountain massif. Except for a few scattered minor districts, the chief fields are the Rhinelands, most important; Upper Silesia second only to the Rhine district; and Saxonia. About 80 to 90 per cent of the coal was produced in the Rhinelands and Upper Silesia, and most of the German iron ore was produced in the section centering upon Lorraine. Zinc was produced in the east and central Germany—about 16 per cent of the world's output. Potash, of which Germany has almost the monopoly, constituted a notable source of Germany's revenue.

The distribution of the coal deposits led to the development of two great industrial centers, one to the west, the great Rhine-Ruhr-Saar district producing 66 per cent of the total coal, and another to the east, the Silesian district producing about 25 per cent. The coal of the Saar valley, because of its excellent gas and coking quality, formed a component part of the Rhine-Ruhr industry, just as the Waldenburg or South Silesian coal did in the Upper Silesian district.

The reserves of iron ore and the proximity of the ore to the coal determined the trend of the diverging evolution of the two districts. As the period of self-

sufficiency of each region ceased with the rapid development of industry and a demand for raw materials beyond the capacity of the districts within themselves, the Rhine-Ruhr district, nearer the foreign supplies, particularly the abundant Spanish ore, forged ahead of the Upper Silesian district dependent upon the supplies from Sweden, Ukraine, Styria and Russian Galicia.

With the close of the war both regions suffered material losses and setbacks. Part of Upper Silesia, ceded to Poland, was lost to Germany, and the Rhine-Ruhr-Saar district was occupied and controlled by foreign troops (Fig. 5). Both these districts constituted integral industrial units, the hearts of German industry, the bases of those superb industrial structures of which the coal pits, the iron works, the gas factories, the high tension electric lines, the railways, the

FIGURE 5.—The very slight coal reserve left in Germany's possession at the close of the war is clearly indicated by this chart. The occupation of the Ruhr territory by foreign troops and the cession to Poland have seriously depleted her stores.

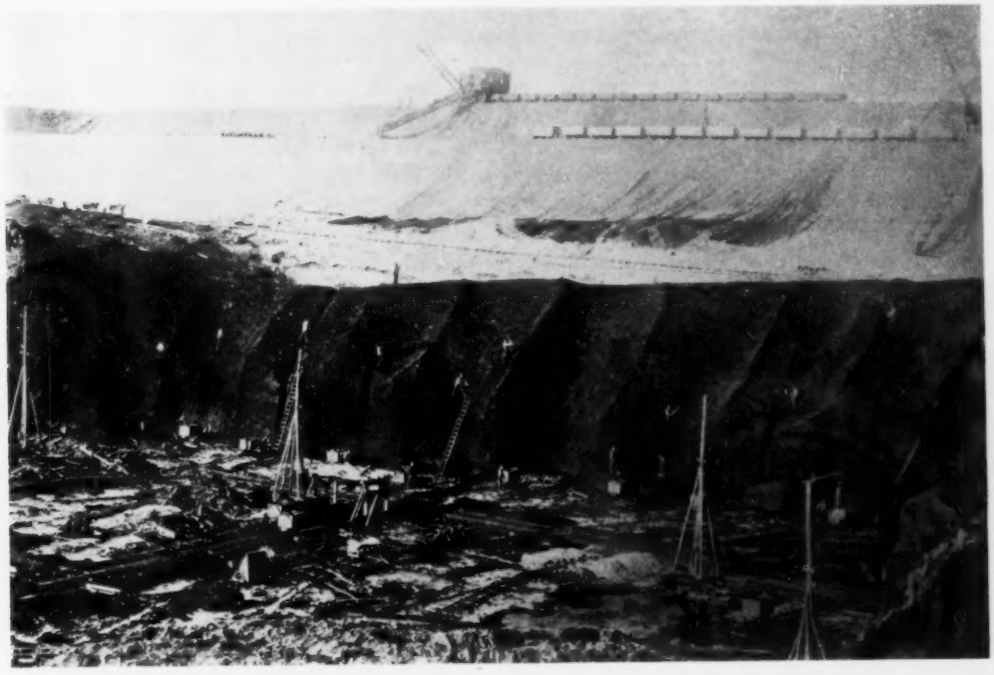

FIGURE 6.—Open pit mines of lignite on the West Silesian heath, where the coal may be most economically mined by stripping the overburden.

attendant manufactures and commerce, the educational and administrative organizations, and the fine residential blocks of the operatives are essential parts.

The severance of the Upper Silesian district into two distinct parts has worked to the irreparable harm of both; for despite every effort to make them

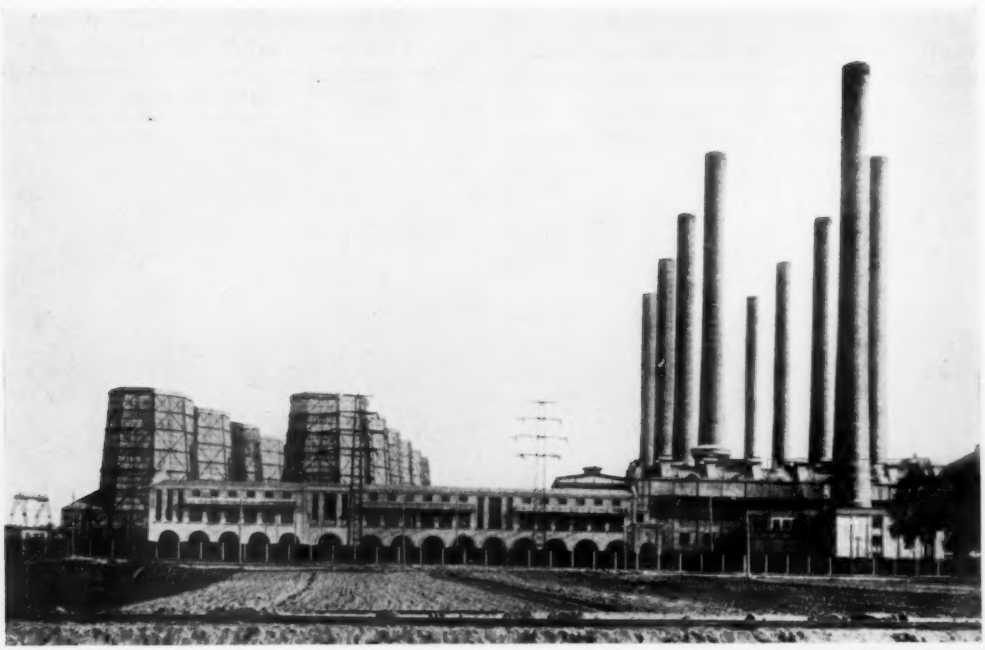

FIGURE 7.—The modern lignite power plant, the Golpawerk, illustrates how the technical skill of Germany is aiding her industries under the post-war restrictions.

function as complementary parts, the industrial organization and unity have been destroyed, and both are struggling to survive. The Polish section is well-nigh dead, while the German section, still struggling, has intensified its industry with some measure of success.

Since the war Germany has developed another fuel resource, the extensive Saxonian lignite which occupy the central lowlands. Though the calorific value or thermal efficiency of lignite is only about one third that of bituminous coal, it is being developed as a substitute for the coal reserves lost, even as during the war it was utilized to augment the supplies of better coal (Fig. 6). This industry is growing apace; even now it exceeds the production of bituminous coal, and new mines of lignite are being opened along the inner margin of the lowlands between the Rhine and the Oder. In the main area of production, including East Silesia, North Saxonia, and East Thuringia, the most densely populated part of Germany, a new industrial district is being formed (Fig. 7). While this brown coal is difficult of use as household fuel, it lends itself rather well to the production of electric energy, manufacturing, railways, and other industrial uses. The center of the high-tension transmission system of Germany lies in this newly developed lignite district, the throbbing heart of a new industrial life (Fig. 8).

EXTENDED DEVELOPMENT OF WATER POWER

The intensive development and extensive distribution of water power constitutes another post-war adaptation of Germany's diminished resources to her greater needs. In the earlier part of the nineteenth century only a few relatively secondary water power projects had been put through in the Rhine mineral district and elsewhere in favorable localities, but during the last fifty years greater reservoirs, bigger dams, and important power stations have been achieved.

Two methods of water power development have been employed: (1) the uti-

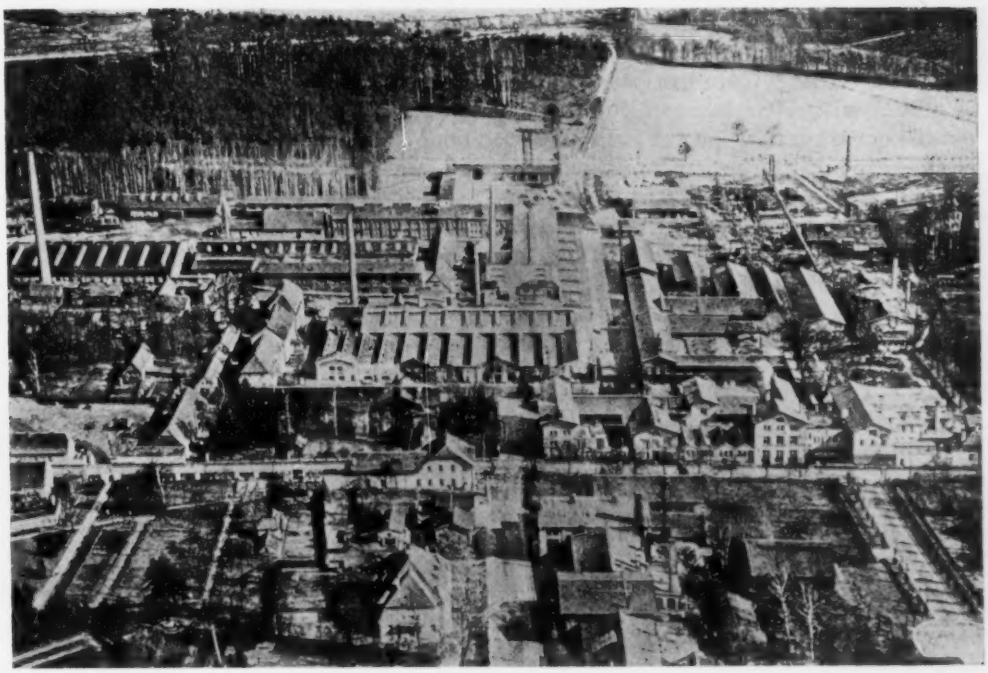

FIGURE 8.—The great machine shops of Werk Lauchhammer, dependent upon the low grade deposits of lignite of the West Silesian heath.

lization of natural sharp breaks in the normal gradient of the stream bed where the power could be easily and cheaply produced; and (2) the production of artificial heads by impounding the waters of the streams in great reservoirs behind high dams where the physical conditions were favorable (particularly to the right of the Rhine and in the Silesian mountains), more expensive and difficult than in the first case. In comparison with the cheap development of water power in Canada and Scandinavia, Germany's projects have been more expensive, but nevertheless the German streams have been well enough adapted to water power development to permit their economical use in the most effective way in building up Germany's industry.

South Germany, with only a few fields of lignite for power, has made the production of water power her foremost concern, and has succeeded to a remarkable degree in harnessing her streams to run her important industries. Bavaria is a striking example of what may be done, for by making the most of her beautiful mountain lakes, the Walchensee and the Kochelsee, she leads the whole country in water power energy produced.[1] Other sections have also completed vast water power projects with extensions being constantly put through.

As a consequence of this well executed program of lignite utilization and water power development, the entire country, except the seaward edge of the lowlands, is netted with high-tension lines carrying electric energy to the centers of distribution of industry already established, and auguring ample supply for new centers yet to develop not only near supplies of raw materials, but wherever capital and commerce may decree.

AUGMENTED EFFICIENCY OF LABOR

The augmented efficiency of German

[1] The water power developed in Bavaria is 393,000 horse power, about equal to that developed from the American part of the Niagara Falls. In all Germany the potential water power is about 6,000,000 horse power of which 1,200,000 has already been developed. Bavaria alone can supply 2,000,000 horse power.

labor is the climactic feature, the most significant factor, in Germany's phenomenal recovery from her heavy losses in territory, materials, man power, and morale consequent upon the culmination of the war and the peace conditions imposed. Crowning her efforts to make the most of her physical resources, the willing response of her people to the heavier demands made upon them and their eager desire to restore her merchant marine, her international prestige, and her foreign friendships to their pre-war standards of excellence, insure her future progress; only by their labor, their strength, their firm faith can they hope to see Germany recover her place among the foremost industrial nations of the world, resume her position among the leaders of thought, and art, and science, and all culture. Like all nations of the world, she finds the way of peace and friendship hard, but best and surest.

FIGURE 9.—The water power of the Alpine foothills in Bavaria has been extensively developed. The beautiful mountain lake, Walchensee, one of Bavaria's lacustrine gems, has been conscripted to the service, without marring its beauty. This remarkable power development is well illustrated in this picture, a graphic presentation of one of Germany's applications of geographic resources to the industries of her people.

THE CRANBERRY INDUSTRY IN MASSACHUSETTS

Carol Y. Mason

Geographer, University of Illinois

THAT the cranberry industry should become important enough to take first place in the agriculture of the southeastern section of Massachusetts is a matter of astonishment to many people. Though cranberries are a luxury the demand for them is great, and can be depended upon from year to year. The holiday custom of turkey with cranberry sauce has become so firmly established that thousands of barrels of berries are sold each November and December, and although sales continue throughout the winter the peak is reached at Christmas time. The total of yearly sales is large.

FIGURE 1.—A typical cranberry bog of southeastern Massachusetts. Wherever the water level of the storage reservoir lies lower than the bog, the water is lifted by engines, and distributed by flumes and ditches. Flooding is necessary for protection against frost, freezing and fire, and sometimes against weeds or insects.

IMPORTANCE OF THE INDUSTRY

Southeastern Massachusetts attained little prominence in agriculture until the development of the cranberry industry (Fig. 1). Early settlers, when they found that the poor soil would not produce crops large enough to support them took to the sea there as elsewhere in eastern New England (Fig. 2). Then in the nineteenth century it was discovered that the peat bogs of Cape Cod could be used for growing cranberries and after successful experimentation, the industry gradually became established not only on the Cape, but in the contiguous mainland wherever similar favorable conditions permitted. Cranberry cultivation has enabled the people of southeastern Massachusetts to utilize land otherwise waste and has made the section a valuable region of specialized agriculture (Table 1). Where the industry is con-

centrated, in Plymouth and Barnstable Counties, the value of the cranberry crop is equal to that of all other agricultural products (Fig. 3).

TABLE 1. ACRES OF CRANBERRY BOGS IN MASSACHUSETTS

COUNTIES[1]	*Acres* 1910	1925
Barnstable	4,433	4,331
Bristol	471	422
Dukes	154	46
Essex	10	10
Middlesex	71	115
Nantucket	292	330
Norfolk	60	55
Plymouth	8,628	8,582
Totals	14,118	13,891

Massachusetts produced more than half the cranberries grown in the United States in 1923. Only two other states, New Jersey and Wisconsin (Table 2), produce large quantities of the berries, although New York, Oregon and Washington add small shares to the crop. Isolated individual cranberry fields are found in parts of northern New England, Virginia, Minnesota, and Michigan, but they produce relatively few berries.

TABLE 2. ACREAGE, PRODUCTION, AND "FARM VALUE" OF CRANBERRIES FOR THE LEADING STATES,[2] 1922

State	*Acreage*	*Production, Thousands of Barrels*	*Farm Value, Thousands of Dollars*
Massachusetts	12,000	305	3,202
New Jersey	11,000	200	1,950
Wisconsin	2,000	55	550

Cranberries are not grown commercially except in the United States. A few areas in Nova Scotia and Prince Edward Island where they were once successfully cultivated, have dwindled to unimportance since the war, not meeting even local demands. Cultivation of a species other than the American cranberry has been tried in northern Europe; the small wild rock cranberry is picked for market in quantities in Norway, but nowhere is there an industry comparable to that found in the three great cranberry regions of the United States.

[1] Figures from Massachusetts Crop Reporting Service, U. S. D. A., Wakefield, Massachusetts. V. A. Sanders, Statistician, C. W. Barber, Assistant Statistician.

[2] Agriculture Year Book, 1923. U. S. Department of Agriculture.

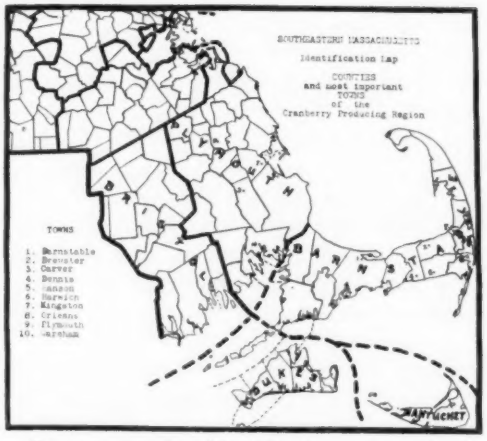

FIGURE 2.—An identification map of the cranberry producing counties of southeastern Massachusetts.

ESSENTIAL GEOGRAPHIC CONDITIONS

The climatic limits of the cranberry industry are wide. The berries can be grown only in a cool temperate climate,

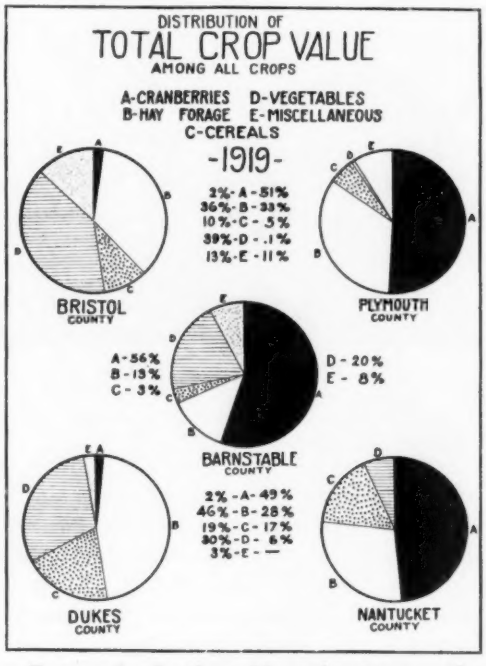

FIGURE 3.—In three Massachusetts counties cranberries approximate one half the value of crops produced, an illustration of the importance a highly localized crop may assume.

where there is at least a moderate rainfall, but such conditions prevail over a large area in the United States.

TEMPERATURE

The cranberry growing season is limited by the continuation of below-freezing temperature rather than by the occurrence of occasional heavy frosts which limit the growing season of other crops, because many cranberry fields are so situated that they may be flooded for protection against frost. The industry is also limited by high summer temperatures; New Jersey, with warmer summers than other sections where cranberries are grown, has a lower yield of berries per acre.

MOISTURE

An annual rainfall of more than 25 inches is necessary for cranberry growing, to maintain a sufficient water supply for flooding the fields whenever necessary. A copious rainfall promotes the development of the type of soil best for cranberry raising.

Atmospheric moisture is desirable, as it lessens the chance of frost. Sun and wind are also significant in the industry; vines grown in the shade expend most of their energy in vegetative growth and bear little fruit, while vines grown in a hollow protected from wind are exposed to frost later in spring and earlier in fall than those grown where wind can keep the air in motion, and cold air can less readily settle and collect at night.

RELIEF

The configuration of the land has much to do with the location of the cranberry industry; the type of soil needed is found only in depressions; the influence of the relief on temperature is significant; and the necessity for draining and flooding the fields, makes low relief desirable. There must be level unit areas of cultivation, so that the water level can be maintained at a uniform height. It is essential that a field be near a pond or stream that can be used as a reservoir from which to obtain adequate water quickly at critical times.

ACID PEAT BOGS

The cranberry industry has developed in areas of acid peat bogs, within the regions which are climatically and topographically suitable for cranberry growing (Fig. 4). The cranberry, like any plant, has physiological requirements which are best met by certain soil conditions, and acidity is most important of these. Loamy materials cause the greatest vegetative growth, but acid soils such as some sands, muds, or peat, yield the heaviest crops of berries. The latter type of soil, valueless for most agriculture, is found in the "Pine Barrens" of eastern New Jersey, in central Wisconsin, and in southeastern Massachusetts, and there the land has become valuable with the development of intensive cranberry cultivation.

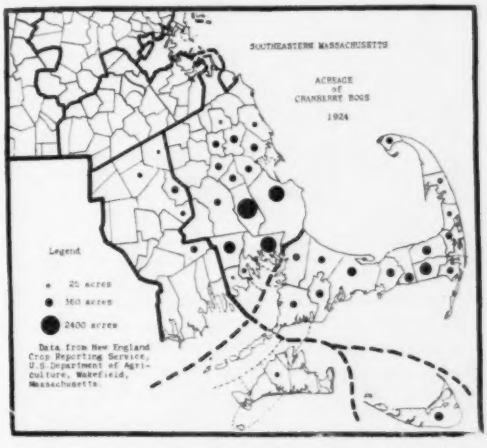

FIGURE 4.—The distribution of cranberry bogs in southeastern Massachusetts, indicates that the industry is largely localized in Plymouth and Barnstable Counties.

SAND

Sand has been found essential in maintaining a high yield of sound berries. Though swamps of acid peat abound in northeastern United States, and on the Pacific Coast, and thousands of them have been tried out for cranberries, cultivation has been successful only in regions where a plentiful supply

of clean coarse sand is near at hand. For this reason the industry has become concentrated in the sandy districts of central Wisconsin, eastern New Jersey, and southeastern Massachusetts. The grower must cover his fields occasionally with a layer of sand in order to obtain a sustained yield of marketable berries.

LIMITING ECONOMIC CONDITIONS

In addition to the physical needs of cranberries, certain economic conditions limit the industry. Until the organization of the American Cranberry Exchange, a national marketing agency of the cranberry growers, the industry was threatened with failure for lack of markets (Fig. 5). This problem solved, and

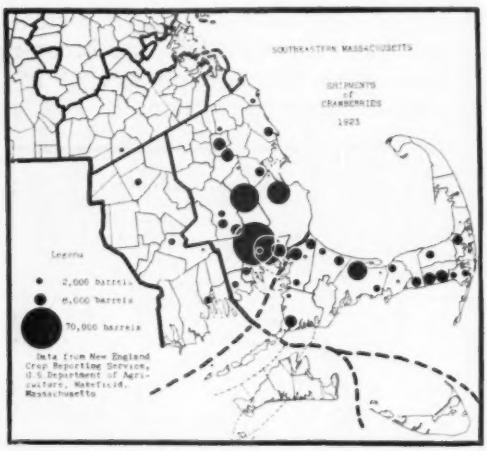

FIGURE 5.—The shipment of cranberries is a trustworthy criterion of production, and this map of distribution of shipments indicates that production, like acreage, is localized in Plymouth and Barnstable Counties.

with it the problem of transportation, the greatest economic limit upon the industry became the labor supply. For most of the year a few men can do the work of the bogs; but during the picking season, which usually lasts six weeks, beginning in early September, a large labor force is required. This heavy demand, for a short time, makes necessary the development of the industry in a region near some densely populated section, where an ample supply of laborers is available.

LIMITING PHYSICAL CONDITIONS

The underlying rock of eastern Massachusetts is highly metamorphosed, for the most part granitic in character. Glaciation has worn away the soil and left the region one of rocky hills and marshy, ill-drained valleys, with scattered deposits of sand and gravel. East of a northwest-southeast line near Plymouth, however, the country is made up of morainal sands, extending out to sea in the great arm of Cape Cod.

RELIEF AND SOIL

The moraine itself, a band of irregular, hummocky hills of general elevation less than 300 feet, extends along the northern part of the region, and includes many ponds and areas of marshland with imperfect drainage. Sloping to the south is the outwash plain, an area of lesser hills and many ponds, traversed by many small streams in well-defined lines of drainage. The end of the Cape, a sand-dune region, is rough, with many marshy hollows.

Most of the soils of the outwash plain areas belong to the Merrimac series, of water-laid material derived from glacial deposits of crystalline origin.[3] It forms relatively level terrane, generally free of stones and boulders. Like all soil, it grades from well-decomposed layers of material at the surface, to the unchanged parent geologic material beyond the depth to which weathering agents have penetrated. A cross section of these layers, called the soil profile, reveals three grades of material in the well-drained soils of northeastern United States. In the sandy loams and sands of the Merrimac series it is the third layer, 20 to 30 inches thick and only six or eight inches beneath the surface, which is most used for sanding cranberry fields. The unchanged sands and gravels below can also be used when dug out. Hinkley sand, related to the Merrimac soils,[4] and found on parts of

[3] Marbut, C. F., Unpublished Lectures, 1924.
[4] *Ibid.*

Cape Cod, is also used for sanding the cranberry bogs.

West of the morainic region the soils, principally of the Gloucester series, are more fertile. Found typically on the uplands,[5] these are derived from crystalline glacial drift, but since they contain more clay than the Merrimac, they are not suited for sanding. Patches of Merrimac and Hinkley soils are widely scattered in this area.

able sand, not elsewhere so associated in New England.

Massachusetts cranberry fields of profitable production are found today in the three counties of Plymouth, Bristol, and Barnstable (Fig. 6). The greatest concentration is in the town of Carver, and another center is in Harwich, but surrounding towns approach them in acreage. West of the moraine area the decrease in number and size of the cran-

FIGURE 6.—The heavy yield per acre in southeastern Massachusetts results from optimum conditions for cranberry growing—cool, temperate climate with moderate rainfall; acid peat bogs readily flooded, drained, and sanded; a labor supply readily available; market and marketing conditions for disposal of the crop.

DRAINAGE, ACID PEAT BOGS, AND SAND

Throughout Massachusetts blocked streams and glacial swamps are numerous, and muck or peat soil abounds in the many hollows of the three southeastern counties. Small areas dot Cape Cod, while larger areas border the ponds and streams of eastern Plymouth County and the adjoining region. Upon the peat soil are found the cranberry bogs. The limitation of the cranberry industry to southeastern Massachusetts is closely dependent upon the favorable location of the swamp lands, in regions of avail-

[5] C. F. Marburt, Unpublished Lectures, 1924.

berry fields coincides with the displacement of Merrimac by Gloucester soils.

The successful cranberry grower must have an accessible supply of clean coarse sand, to spread on the bog before the vines are planted, and so keep down weeds and moss. The roots of the cranberry plant can grow with better drainage and aeration in sand than in peat. Sand tends to promote fungus diseases, but this disadvantage is outweighed by the benefits it affords except in the warm climate of New Jersey. In some sections sand is inaccessible; and where sanding can not be practiced, production is noticeably less than in Massachusetts,

where all the bogs are sanded. In well-kept sanded bogs a yield of 50 barrels per acre is common (Fig. 7).

The quality of the peat itself, as well as the nearness to a supply of sand, must be considered a vital factor in the location of cranberry bogs within a region. The cranberry grows in a plant association typical of one period in the history of a swamp. "As a lake or pond fills up, water lilies appear, then rushes, then moss and bushes such as leatherleaf, followed in turn by blueberries, cedars, and finally swamp maples and other trees. The cranberry is found on that part of a bog which has reached the 'leatherleaf' stage, and a bog covered with leatherleaf is considered an ideal site for cranberries".[6]

Massachusetts bogs are of all sizes, from half an acre to 250 acres (the area of the largest bog, which is on the island of Nantucket), most bogs do not exceed ten acres, and all large ones must be divided into smaller units for flooding, as well as for proper drainage (Fig. 8).

The moraine area of Plymouth and Barnstable Counties contains relatively few cranberry bogs; although some marshy land is found, the lack of streams makes it difficult to secure proper drainage and flooding facilities. The outwash plain area, on the other hand, has broad swamps along the small streams, and wide expanses of these have been developed as cranberry bogs. Here the rivers facilitate the flooding and draining of the bogs.

FIGURE 7.—Sand in proximity to the bog reduces the cost of sanding and tends to lower cost of production. Such clean coarse sand as may be obtained from the glacial deposit bordering the bog illustrated in this picture is an important factor in the profitable operation of the bog.

Cranberry bogs must be drained to a depth of eighteen inches below the surface to allow proper growth of the roots, for although roots and vines will live under water for months at a time they cannot grow while submerged. Though

It is possible to flood almost all the developed bogs of Massachusetts. Most bogs are flooded during the winter for protection against cold, and in spring and fall, for frost protection. The bogs should be drained rapidly after flooding in the picking season, for the berries do not keep well if picked while wet, and much time is lost in waiting for them to dry.

[6] Darrow, Franklin and Malde, Establishing Cranberry Fields. U. S. D. A., Farmers' Bulletin 1400.

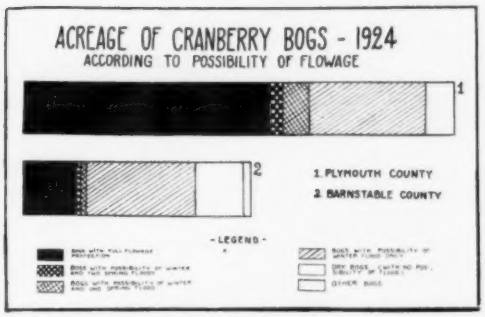

FIGURE 8.—The relationship of profitable acreage to convenience and possibility of flowage is graphically presented in this chart.[7]

Bogs are sometimes flooded in spring or summer to destroy insect pests or weeds, and in fall to save them from forest fires which always constitute a hazard in the eastern part of the state, more particularly in the sandy regions of the Cape, where the sandy soil dries out quickly and high winds are common. Flooding or letting water stand in the ditches for irrigation is sometimes expedient in an exceptionally dry summer like that of 1924.

CRITICAL CLIMATIC CONDITIONS

Massachusetts lies well within the climatic limits of cranberry growing. There is abundant rainfall to keep up the supply of water for flooding, and single rains are seldom severe enough to damage the fields. Although fogs are common they have no apparent effect upon vines or berries. The summers are not warm enough to cause much trouble from fungus growth, yet the growing season is so long that flooding for frost protection is rarely necessary except at extremes of the season.

Wind direction is an important factor in the cranberry industry. Westerly winds predominate in southeastern Massachusetts, and although their tendency is to make the climate more like that of the interior, the influence of the neighboring ocean is nevertheless marked. From April to September, inclusive, the southwest wind prevails. Cranberries are combed from their vines with toothed scoops; to minimize injury to the plants the scoops work "with the wind."

During September the wind is northerly half the time or more, and increases the frost hazard, already imminent with the approach of the cold season. Bogs are usually flooded for protection against light frosts, such as may occur early in September. In spite of danger from frost, somewhat cool temperatures during the picking season are advantageous to the successful storage of the berries, for if stored cool in a cool place as soon as they are picked they are not likely to sweat and shrivel.

Largely because of their lower position, cranberry bogs cool to lower temperatures than the surrounding country at night. Frosts sometimes occur in patches on a bog, or in the lowest section only, not only because of the drainage of cold air down the slopes, but because of varying conditions on the bog itself. Experiments carried out in Wisconsin showed that newly sanded, thinly vined, and well drained bogs were warmest on all nights.

A formula for predicting minimum temperatures has been prepared by Dr. Henry J. Franklin of the Massachusetts Agricultural Experiment Station in East Wareham,[8] and with this and a daily weather map from the United States Weather Bureau the cranberry grower can predict frost with a fair degree of accuracy, provided he knows conditions on his bogs. A special warning is sent from the Experiment Station to all large growers when frost threatens.

Many acres of "dry bogs" in Massachusetts can not be flooded at all. Owners of these bogs frequently suffer severe losses because of winter-killing or spring or autumn frosts. Only the high price of cranberries prevents the complete abandonment of such bogs.

DEVELOPMENT OF CRANBERRY GROWING IN MASSACHUSETTS

Cranberries were first cultivated at North Dennis, Massachusetts, between

[7] See Footnote 1.

[8] Franklin, H. J., "Cape Cod Cranberry Frosts" in Suppl. 16, Mo. Weather Rev., 1920.

1810 and 1820.[9] Very soon after it was discovered accidentally that a thin layer of sand over the ground improved the quality of the berries, and by 1850 the practice of sanding had become common. Until then constant uncertainty and frequent failure had attended the industry, but thereafter with assurance of success and profit, rapid increase in acreage and yield per acre followed.

By 1875 the knowledge that cranberries could be grown on peat bogs with great profit had spread westward through Massachusetts, and berries were produced in 268 towns of the state. Except in the region of Cape Cod and vicinity, where conditions are peculiarly adapted to the industry, the industry gradually failed, and by 1924 scarcely 100 barrels were produced beyond the four southeastern counties of the state.

Even as early as 1895, 90 per cent of the total crop of the state was produced in Plymouth and Barnstable Counties. The factor of greatest importance in the development of the industry was, from the first, the accessibility to a plentiful supply of clean, coarse sand; and the factor of next importance the extent of peat-areas bordering small streams, where flooding and drainage were easy.

COÖPERATION IN MARKETING

For many years it had been difficult for individual growers to market their crop, because the cost of transportation was relatively high, and buyers were able to force a low price. In 1895 two companies were formed, the Growers' Cranberry Company, composed of the larger growers of Massachusetts and New Jersey, and The Cape Cod Cranberry Sales Company, composed entirely of Massachusetts Growers. Each hired the most efficient cranberry salesman available, one with his office in Philadelphia and one in Boston. The business of these men was to predict the demand for berries, and to direct shipments to avoid "glutted" and "famine" markets. They failed in complete coöperation, however, since each grower's berries were sold individually, and his profit depended upon the price received for his own berries.[10]

An exceptional crop in 1906 flooded the markets, and only members of the cooperative companies were able to maintain a profitable price per barrel. Individual growers lost heavily, members of companies made only slight profits, and the outlook for the industry was dubious. The prospects for a still larger crop the following year forced the growers to united action. They realized that instead of competing for markets they must coöperate, if the industry were to continue.

With the organization of the Wisconsin Cranberry Sales Company, in 1906, a new epoch began. In this company, to which 90 per cent of the Wisconsin growers belonged, members agreed to pool their berries, and sell under standard labels. Immediate success crowned their agreement and their selling agent was asked to come east to explain his methods, with the result that the New England Cranberry Sales Company, and the New Jersey Cranberry Sales Company, united with the Wisconsin Cranberry Sales Company to form the National Fruit Exchange. The Growers' Cranberry Company, realizing that successful competition was impossible, merged with the American Cranberry Exchange in 1911, and the Cape Cod and New Jersey Cranberry Sales Companies went out of existence.

At present, in 1925, most small companies and individual growers are members of the three state Cranberry Sales Companies. The American Cranberry Exchange acts as a selling agent for all members. Berries are pooled and graded according to fixed standards, and operation is on a non-profit basis. Each company maintains a small surplus, but

[9] Darrow, Franklin and Malde, Establishing Cranberry Fields. U. S. D. A., Farmers' Bulletin 1400, p. 1.

[10] Hobson, A. and Chaney, J. B., Sales Methods of a Growers' National Marketing Agency. U. S. D. A., Bull. 1109, p. 5.

beyond that amount any excess after members are paid for their contributions of berries is divided among members according to the acreage of bogs they own. The Exchange, owned exclusively by the three state companies, divides its surplus among them.[11] A large per cent of the crop is sold annually through the exchange.

Security of markets and stabilization of prices constitute the chief advantages of the coöperative companies, but almost as advantageous is the ability of their members to borrow money, in advance of their crops, to help pay the cost of production for the year. Expensive machinery and buildings are needed, and labor is high priced. A grower who has only a small bog often finds it difficult to meet immediate financial needs when he must wait for the sale of the bulk of his crop in December, before receiving payment for it. The companies thus enable small growers to succeed with comparatively small capital.

[11] Hobson and Chaney, Sales Methods and Policies of a Growers' National Marketing Agency. U. S. D. A., Bull. 1109, pp. 713.

Central screening and packing houses especially constructed to keep the berries cool and in good condition while they are prepared for shipment are built in the cranberry districts. A few "native" farmers and tradesmen, such as mechanics and carpenters, work in packing houses, drive trucks to market or railroad, and oversee the work of the bogs. It is their wives and daughters who work in the screening houses in the fall, sorting and packing the berries.

LABOR SUPPLY

The Portuguese do most of the work on the bogs (Fig. 9). Some of these men and women live in the towns of Cape Cod and vicinity, while the others live near the bogs, in tiny houses built for them by the growers. When picking was done exclusively by hand both men and women did the work, but the scoops now used are too heavy for most women to use. Pickers, chiefly Portuguese mill-workers from the industrial towns south of Boston, pour into the section each fall, seeking employment in the fields.

FIGURE 9.—Portuguese pick most of the cranberries on Cape Cod. The scoops are too heavy for women to handle, so men are almost exclusively engaged. In the old days of hand picking, whole families took part in gathering the crop.

Throughout the year about one man

for each 10 or 15 acres of cranberry bog, is needed in the industry, to keep the dikes, flumes, and ditches for flooding the bogs in excellent condition, to rake the bogs after picking, to resand them every third year, to spray for insects, and occasionally to flood the bogs for special purposes and to keep the machinery and other equipment in good condition. During the picking season the number of men employed varies with the size of the crop, but ordinarily about one man for each 100 barrels suffices for cranberries. A picking machine with pneumatic tires has been recently developed, and was tried by the growers for the first time in September, 1925. It does not crush the vines, and it is said to tear them no more than scooping does. This machine will materially reduce the amount of labor needed during the picking season.

PRESENT TENDENCIES

The per capita consumption of cranberries in the United States is large. Massachusetts ships to almost every state in the Union. In spite of a fluctuating crop the Exchange has been able to place a high price on berries and to dispose of the entire crop each year. By skillful advertising, the demand for cranberries has been developed for other times of the year than the holiday season.

The slight decrease in the acreage of cranberry bogs in Massachusetts from 1916 to 1924 took place largely in the border area just beyond the region of optimum conditions of soil and topography, but some bogs within the favorable region have been abandoned because labor costs are too high to make it worth while for a small grower, not a member of the New England Cranberry Sales Company, to try to compete with his more successful neighbors; and some bogs have been abandoned because of the risk consequent upon lack of facilities or water for flooding.

The distribution of the 1924 acreage of cranberry bogs in relation to the possibility of flowage is shown in Figure 8. In the best region, in Plymouth County, there are few dry bogs, while in Barnstable County, with less land favorable for cranberry culture, there is a larger acreage, and likewise a higher percentage of unfavorable areas of cultivation.

The canning of cranberries has become an important industry in South Hanson, Massachusetts, within the last few years. The United Cape Cod Cranberry Company has the largest cranberry canning factory in the United States. Until 1922 only 5,000 cases of canned cranberries were sold in the markets of the entire world, but in 1924 more than 100,000 cases were packed by this one company and shipped to practically every large city of the United States, and to many foreign countries.

Little possibility of the expansion of the cranberry industry in southeastern Massachusetts can be expected since nearly all the peat land favorably situated is already cultivated. Except for the "dry bogs," however, few areas will be abandoned, for the industry thrives wherever conditions are favorable. With improved picking machines and increasing knowledge of the best "farm practices," production in Massachusetts may be extended somewhat, and become less expensive. Physical conditions in the region are so exceptionally favorable that no danger of a decline of the industry need be expected unless some unforeseen factor enters in.

The American Cranberry Exchange, which markets berries from all three of the principal regions where they are grown, eliminates the danger of unfavorable competition. Wisconsin and New Jersey, with large areas of undeveloped swamp land, may in time probably surpass Massachusetts in acreage and production, but in yield per acre, and in quality of berries, Massachusetts will probably always hold the lead. The cranberry industry, perhaps nearly at its height in Massachusetts, has a bright future there. Almost unlimited possibilities in the increase of consumption of

the berries throughout the world may be developed by judicious advertising, and as long as the demand continues, Massachusetts will remain one of the leading regions of production; with the expansion of the canning phase of the industry to promote consumption throughout the year instead of only through the winter months, the demand may be immeasurably increased.

FIGURE 10.—The well-built screening houses in which the berries are prepared and stored for market represent the investment of considerable capital, and are sometimes the joint property of the several growers in a community, or of a cooperative association.

THE BRITISH FISHERIES

Ll. Rodwell Jones

Professor of Economic Geography, University of London

AT first sight there is something a little odd about the association indicated in the title *Ministry of Agriculture and Fisheries*, the name applied to a Government Department of Great Britain. True, it has not the libellous incongruity blatant in the term *Court of Divorce and Admiralty*—a branch of the British Judiciary; and indeed a little reflection—on the part of the geographer at any rate—will serve to discover a certain aptness in the former association, which for the credit of our Senior Service, we continue to deny to the latter! For the harvests of the sea, as those of the land, are conditioned by geographical circumstances. Variations in depth, in salinity, in temperature, of the sea; variations in the character of the sea bottom, of the sea plankton, and even of the weather; all are concerned in the quantity and quality of the harvest. The fields of the sea, as those of the land, may become impoverished. The science of their recovery is less advanced than in the case of agriculture, but all signs point to benefits likely to accrue from further scientific investigation and control. Naturally in both cases progress has been greatest in the perfection of the instruments of harvest, and has lagged somewhat in the elucidation of the principles of conservation.

It is our purpose in this article to describe the industry as it is today. We have not space to investigate the historical side of the subject, though the field is one of the richest and most interesting awaiting historico-geographical research. The evolution of the industry is inextricably interrelated with the growth of our Sea Power, with the extension of the Empire, and with our industrial development. The Royal Fishery Companies of the seventeenth century bespoke more than an effort to develop British fisheries; they indicated an indirect attempt to undermine Dutch Sea Power. Our fishermen were busy on the Banks of Newfoundland a century before the sailing of the Mayflower. The industrialism of the nineteenth century was accompanied by so rapid an increase of population that now some 180 million people live in the countries bordering the shallow fishing waters of Western Europe.

But here and now we must confine our attention to the fisheries as supplying a commodity of modern commerce, the geography of which is concerned with the distribution of fishing grounds, of ports, and of markets.

Sixty-four per cent (by weight) of the fish landed in England and Wales in 1923 were caught by the trawl, which is only used in shallow water, usually less, often much less, than 200 fathoms. Nearly all of the remaining catch is shoal fish of the herring type caught in drift nets. The shallow water of the West European continental shelf is the scene of both fisheries. Fig. 1 is a map showing sea depth. The approach of the hundred and thousand fathom lines just west of Ireland shows us the extent of the continental shelf. If the land rose but 100 feet, England would once more become attached to the continent, the real edge of which comes with the sudden descent to oceanic depths just west of Ireland. The British Isles then, rest on a broad, very slightly submerged ledge put out from the continent. They are entirely surrounded by shallow water and similar shallows surround the Faroes, Rockall, and most important of all, Iceland. The North Sea—as artificially delineated on the map—forms the shallowest area of these waters. All of it is

less than 200 fathoms deep, except for a long, narrow, deeper gulf, parallel and close to, the coast of Norway. The northern part of it is between 100 and 200 fathoms, but everywhere to the south of a line joining Peterhead and Jutland the North Sea is less than 100 fathoms. It shallows still more to the south and actually at the Straits of Dover most of the crossing is over water less than 100 *feet* in depth! This graded shallowing from north to south is interrupted by many minor banks and pits. The largest and most important shallow is that of the Dogger Bank, an oval shaped submerged plateau, 6,850 square miles of which is less than 20 fathoms deep. Its axis is N.E.-S.W. and the broad southwestern end is but 60 miles from the Yorkshire coast. The bank slopes most steeply to the northwest, and quite gradually to the southeast. It is entirely surrounded by deeper water, all of which is, however, less than 100 fathoms. South of this interruption the shallowing progresses steadily to the Straits of Dover.

Apart from the North Sea the continental shelf is a little deeper—notably in the Irish Sea, where occasional isolated pits sink to more than 250 fathoms. There is deeper water, too, on the hake-trawling grounds immediately to the southwest of Ireland. There is no trawling at a depth greater than 250 fathoms. Even at less than this depth much of the shelf is unsuitable because of too rough a character.

The Continental Shelf, then, in itself, and with its concomitant circumstance of tidal currents of varying temperature, and distributions of varying terrigenous deposits, provides the chief set of geographical factors concerned in the British fisheries.

Each of the classes of edible fish has certain characteristics of habit and of habitat. None of these are so outstanding as those which serve to divide the fisheries into two main groups—Demersal and Pelagic. Pelagic fish live and are caught near the surface, though the eggs of the most important of these, the herring, are deposited at the bottom, on rather shallow and usually rocky grounds. Of less importance among pelagic edible fish are the mackerel and the pilchard.

Demersal fish live at, or near, the bottom, and are caught by the trawl. Their spawn, however, floats near the surface and often forms a part of that mass of floating organic substance to which the name plankton is given. Plankton is to the life of the sea what the pastures are to the life of the land. It consists most essentially of diatoms and algae, minute organisms with power of transforming—under the influence of light—the elements of the air, and the salts of the sea, into organic matter. Living upon these, and forming part of the plankton mass, are myriads of small sea animals,—quite notably the small crustacean, copepeda, and also larval crustacea and mollusca. Floating in the mass, too, may be large quantities of fish spawn. The whole forms a sort of reservoir of fish food, and since the fundamental supply of algae and diatoms varies in amount with each year's climatic conditions, so too does the food supply of the edible fishes—particularly of the very young—suffer corresponding variations. In years when plankton is abundant there is a low rate of infant fish mortality, and this again accounts for the fact that of the catches of adult fish so many are of the same age—they have survived because hatched out in a good food year. While still very small, Demersal fish leave the surface waters and depend for their food supplies on small bottom-living crustacea and mollusca. The pelagic fish, on the other hand, are direct plankton feeders, their gill-rakers straining off the plankton from the continuous stream of water passing through. Experiment has proved quite definitely that plankton is more abundant, if less diverse, in the cooler waters of high latitudes, than in warm and tropical seas. This is probably due to the greater quantities of denitrifying bacteria present in tropical waters.

Let us consider first the Demersal fisheries. The first question arises as to geographical distribution. Are certain of the chief edible varieties confined to certain areas of the continental shelf? Here the statistics of the Ministry of Agriculture and Fisheries come to our aid. The British trawlers, on arrival at port, have to declare not only the quantities of the various types caught, but also the region of the catch. For this purpose the West European fishing grounds have been divided, somewhat arbitrarily, into a number of fishing regions. These are delimited on Fig. 1, where also the catch of each region—for English and Welsh ports only—is recorded. Before examining these, however, it is as well to know something of the relative importance of the chief types caught. Such information is summarized in the table below.

TOTAL WEIGHT OF VARIOUS FISH LANDED AT ENGLISH, WELSH AND SCOTTISH PORTS IN 1923 (IN MILL. OF CWTS.)

Demersal Fish	
Prime Fish:	
Brill	0.02
Sole	0.09
Turbot	0.09
Cod	2.56
Haddock	2.78
Whiting	0.47
Hake	0.68
Halibut	0.21
Plaice	0.75
Skate and Ray	0.60
Livers	0.21
Coalfish	0.29
Catfish	0.24
Others	1.19
Total Demersal	10.18
Herring	6.28
Mackerel	0.25
Pilchard	0.07
Other Pelagic	0.05
Total Fish (excluding Shell Fish) mill. cwts.	16.83

We notice that certain types, as sole, brill, and turbot, familiar on every British restaurant menu, occur in comparatively small quantities. They, in fact, constitute the prime fish of the trade, and command the best prices.

The averaged catches of a trawler in waters off the western coasts of the British Isles gave the following results:

Description	*Percentage Weight*	*Average Price per Pound*
Prime	0.9	10 d.
Large Hake	16.5	6 d.
Small Hake	12.4	3 d.
Cod	25.9	$4\frac{1}{2}$ d.
Flat Fish	3.0	$4\frac{1}{2}$ d.
Large Haddock	2.8	$4\frac{3}{4}$ d.
Small Haddock	4.0	$2\frac{3}{4}$ d.
Coalfish, Ling and Whiting	34.5	1 d.

Not the total weight alone, then, but the kind and size of the fish, and the state of the market, are concerned in the value of a catch. Prime fish form a very small proportion of most trawl catches.

Now if we examine the *areas* of these catches (see Fig. 1[1]), the following generalizations may be formulated—considering demersal fish only.

(1) The North Sea and Iceland are by far the most important grounds.

(2) The percentage of cod (about 50 per cent in Icelandic waters) diminishes rapidly toward the south of the North Sea, and south of Ireland.

(3) Haddock form the predominant catch in the northern, deeper part of the North Sea.

(4) The sole—never, of course, a big percentage—is, in the North Sea, practically confined to grounds south of the Humber. It is important, too, in the southern Irish Sea, and the Bristol and English channels. It forms an extraordinary large proportion of the small totals landed in British trawlers from Biscayan and Moroccan waters.

(5) The plaice has a wide range. It forms the raison d'être of the White Sea (Barentz Sea) fishing. It forms also a very important branch of the North Sea fishing where diminishing plaice returns have been the subject alike of much anxiety, and of considerable scientific investigation. It is relatively important in the Irish Sea, too, but not in any of the southern regions.

[1] Note the table in Fig. 1 is got out for England and Wales landings *only*; it does *not* include Scottish landings because the fishing statistics of the two countries are not available in corresponding forms.

BRITISH FISHERIES
Catch from each Fishing Region
(000 cwts)

Region	Total	Cod	Haddock	Plaice	Hake	Skates	Whiting	Halibut	Soles	Herring	Mackerel	Mustard
1	2974	918	1081	864	–	2	–	32	–	–	–	–
2	69	23	39	2	–	–	–	–	–	–	–	–
4	58593	5591	13413	4485	188	1278	2292	89	394	26284	–	311
5	836	327	179	3	24	69	25	10	–	4	–	5
6	6476	989	1042	42	1566	403	137	38	3	81	–	60
7	16592	8355	3163	101	–	199	14	1138	–	–	–	–
8	6042	3346	1119	24	1	64	3	166	–	–	–	–
9	306	61	103	–	1	33	–	35	–	–	–	–
10	1385	4	32	–	887	70	1	2	–	4	–	3
11	2384	313	15	297	280	534	203	–	88	136	–	9
12	7930	235	105	29	3336	685	85	13	34	987	–	439
13	3005	89	3	22	43	304	160	1	191	910	–	803
14	5567	23	–	174	16	574	252	–	54	1907	691	713
15&16	39	–	–	–	4	23	–	–	8	–	–	–
17&18	600	1	–	–	277	154	–	–	80	–	–	–

FIGURE 1.—The chief fishing grounds contributing to the British catch. The fishing grounds have constituted a training field for Britain's excellent seamen, throughout her long record of sea power.

(6) Halibut is a northern type, and really heavy catches are confined to Icelandic waters.

(7) Hake, skate and ray are predominant west of Great Britain; hake, in particular, being almost confined to the southern area of these waters and actually forming the most important part of the catch in the relatively deep trawl grounds south of Ireland.

We see, then, that the various regions of the Continental Shelf add, each of them, a characteristic quota to the total catch. A much greater subdivision is possible, for the predominant types of fish caught vary very much with local variations in the depth and character of the sea bottom, within each region.

The chief British mode of fishing for all these varieties is by the trawl. The trawl is a wide-mouthed tapering bag of netting, pulled along the bed of the sea by its attendant boat. The method emerged in something like its present form at the fishing station of Brixham (Devonshire) towards the end of the seventeenth century. Until 1870 sailing vessels were chiefly used; the sphere of action was less, the boats smaller, the dependence on the weather greater, than is the case today. The mouth of the early trawl net was kept open by a

beam of wood—hence the name beam-trawl. We have not space here to follow these south coast trawling developments round to the rich fishing grounds of the East, where, by the way, many fishermen of Devonshire origin are to be found today. Steam power was first used in trawling in the form of a supplementary tug, which was attached to the sailing trawls when wind conditions rendered such an assistance profitable. It was a natural development to the modern steam trawler. A modern trawler is a triumph of the adjustment of means to ends. It demands a naval architecture all its own, and is, in fact, made by specialist shipbuilders away from the usual ship-building yards. Deep launching water is not required, and trawlers are built of materials assembled at Beverley, Goole and Selby, all of which have water communication with the Humber, and therefore with the great trawl-fishing ports of Grimsby and Hull. A post-war steam trawler may be 150′–170′ long, is fitted with triple expansion engine, and has a bunker capacity of 250 tons, and fish capacity of 60 tons. Actually size and design will vary somewhat with the kind of work expected. Trawlers built for the Icelandic and distant fishing are larger than North Sea trawlers. The engine, main bunker, skipper's and engineers' quarters usually occupy the after half of the boat. The forward half is occupied successively by the reserve bunker (coal outward voyage, fish inward), the main fish bunker (divided into pounds by detachable boards), net and gear room, and crew's quarters. Some of the fish pounds are filled with ice on the outward journey.

The North Sea trawler—a smaller boat—absent only three to six days, does not require the capacity for fuel, ice and fish, proper for the Icelandic boat, which is often absent from port three to four weeks. Speaking generally, it is the greater average catches per day's actual fishing in the distant waters, as compared with the decreasing catches experienced in the North Sea, which accounts for the increasing proportion of distant fishing. The table below elucidates this point.

Region	*See Numbers in Fig. 1*	*Average Duration of Voyage*	*Average Catch per 100 hrs. Fishing*
Barents Sea..	(1)	25.9 days	865 cwts.
Iceland.....	(7)	21.8 days	724 cwts.
Faroes.....	(8)	14.9 days	420 cwts.
Rockall.....	(9)	10.8 days	361 cwts.
South of Ireland.....	(12)	9.3 days	190 cwts.
North Sea....	(4)	6.1 days	90 cwts.

Two other methods obtain in the British Demersal fisheries, viz., seine and line fishing.

QUANTITY OF WET FISH LANDED IN ENGLAND AND WALES BY FIRST CLASS BRITISH FISHING VESSELS (IN MILL. CWTS.)

	Trawling	*Lining*	*Danish Seine*
1909.....	8.41	0.39	0.00
1913.....	8.41	0.31	0.00
1920.....	9.18	0.25	0.00
1923.....	7.20	0.46	0.43

The great increase in seine fishing is at once noticeable. It really dates—in the British fisheries—only from 1921. It is a method practised and perfected mainly by the Danes. It differs from trawl fishing chiefly in that the net is moved while the vessel remains stationary. As practised in the Danish fisheries, motor boats, smaller than our steam drifters, sail out with what is essentially a bag of netting attached at the center of a very long (sometimes a mile) hauling rope. The fishing area is selected; a buoy with moorings is dropped. To this is attached one end of the 2¼″ manilla haul rope. The vessel now lets out the haul rope and net on a triangular course, the shortest side being opposite the buoy at the apex, and the net being in the middle of this shortest side. Returning then to its starting point—the buoy—the ship stops, and the motor-winch aboard gradually hauls in the triangle of rope and net. The two ropes on either side of the net, moving at first inward and towards the ship, stir up the bottom fish toward the path of the approaching net. When the net is alongside, the fish are baled out

with a huge landing net until the catch is sufficiently reduced for the cod-end to be hauled aboard.

In seine fishing, good results are not usually obtained at night or on stony ground, nor is the fishing usually pursued in regions of strong currents. It is most successful on sandy, shallow bottoms, and haddock preponderate in the catch, which on suitable grounds, is larger than with the trawl. These Danish vessels, cut off from their customary markets by the post-war economic difficulties of continental Europe, began to land seine-caught fish in England. The landings increased greatly when our trawlers were laid up by the coal strike of 1921. British fishermen then had a practical demonstration of the efficiency of seine-net fishing. Since the war many of our herring drifters were idle because of the lack of their greatest markets—the Baltic countries. Some of them took up seine fishing, and it is now an established method followed by some 200 steamers, especially in the North Sea. The figures above reveal it as an important branch of the industry.

A third method of taking demersal fish is by means of long lines having baited hooks at intervals. The line may be literally miles in length and attached to it at regular intervals are snoods—pieces of line 2′–3′ long, carrying the hooks. The line is usually shot at night and fished in the morning. The method is predominant on the Newfoundland Banks and in Norwegian waters. In the Scottish fisheries of 1894, line-caught fish nearly equalled in amount the trawl-catch. This proportion has dwindled to 37 per cent (1923) and the method is relatively unimportant for England.

We have seen how our fishermen are forever seeking new and distant grounds, hoping to make up by increased catches for the time lost on the journey. In particular the North Sea is now yielding lower returns per hour of fishing than ever before in its history. There was some improvement immediately after the war, because of necessity the grounds had been rested. The catches of 1919 were large They have steadily fallen off again since.

The table below shows the quantity of plaice landed in England from the North Sea by steam trawlers and the average catch per day's absence from port for 1911–1914 and 1919–1923.

NORTH SEA

Year	*Quantity of Plaice (in Mill. Cwts.)*	*Quantity per Day's Absence*
1911	.40	2.6
1912	.39	2.3
1913	.35	2.1
1914	.27	2.0
1919	.43	4.5
1920	.59	3.4
1921	.39	2.6
1922	.37	2.2
1923	.31	1.9

The plaice is a characteristic and valuable North Sea fish. It is thought that it may be economically possible to transplant large quantities of immature plaice from the eastern marginal shallows of the North Sea to the Dogger Banks. In the former area they have at present insufficient food material. In the latter there are few plaice and much food material. The suggestion is neither haphazard nor unreasonable, but rather the outcome of prolonged research of British and Danish scientists. The plaice is a somewhat sedentary fish variety, and depletion of a region is quite possible. In order to learn the extent and nature of such migration as plaice achieve, the fish have been marked with a little disc and returned to the sea. It is a comment on the overfishing of the North Sea that so many of them have been recaught. A small reward is made to fishermen who return the marked fish to the experimental station together with information as to the date and locality of capture. Thus the seasonal migration of plaice in the North Sea and Irish Sea has now been somewhat fully investigated.

It is now known that in the North Sea the plaice move southward towards the Straits of Dover in the spawning season, and later the immature fish drift slowly

FIGURE 2.—The numbers of each fishing port include pelagic fish, chiefly herring, in light type, and demersal fish practically all else, in heavy type. The northern ports receive dominantly the pelagic catch; the southern ports, almost all demersal.

toward the shallows of the Danish coast. For many years the Danes have captured young plaice on these grounds and have removed them in tanks to near-by areas of better food supply with good results. Now the Dogger Bank is known to abound in good plaice food, but the young immature plaice in their migration northeast seem to have avoided it, partly no doubt, because it is surrounded by rather deeper water than that usually frequented by the species. For some years now the British Board of Fisheries have experimented by taking young plaice from just outside Danish waters, by marking them, and by then transferring them to the Dogger region. When recaught, these plaice are found to have developed at an astounding rate. Their growth, in fact, has been between two and three times as great, for the same period, as in the case of specimens of the same original age and size which have spent the whole time in the shallows off the Danish coast. It is perhaps possible that the transference might be made on a commercial scale. Millions of plaice could be caught by the Danish seine—it rarely damages the fish—and transferred in welled vessels for liberation on the Dogger. The scheme is receiving consideration.

It remains to deal with the trawl fish port. Over 150 coast settlements of England and Wales alone land fish in quantities sufficient to have their catches recorded in official statistics. Seven only of these (North Shields, Hull, Grimsby, Yarmouth, Lowestoft, Milford and Fleetwood) accounted for just over 81 per cent by weight of the total catch in 1923. We are confronted at once with what is a modern characteristic of the industry—its concentration at a few great ports. In England only Yarmouth and Lowestoft have *very* large herring landings (Fig. 2), and the others in the list above are mainly concerned with demersal fish. In Scotland the position is reversed, 63 per cent by weight of the catch is herring, but the only big demersal ports Aberdeen and Leith, have small herring catches. There are also fewer fishing stations. Some Scottish ports land great quantities of herrings, yet are really quite small towns with inferior internal communications. We notice, then, that it is unusual for ports with very large catches to combine herring and demersal fishing, and we notice also that similar port facilities are not required by the two fisheries. Herring fisheries are seasonal, the catch chiefly for curing of one sort or another, and for export. The demersal fisheries are prosecuted throughout the year, by bigger vessels, fitted out for longer voyages. Inland communications are of more importance because most of the fish is for the home market. For the moment we will confine our attention to

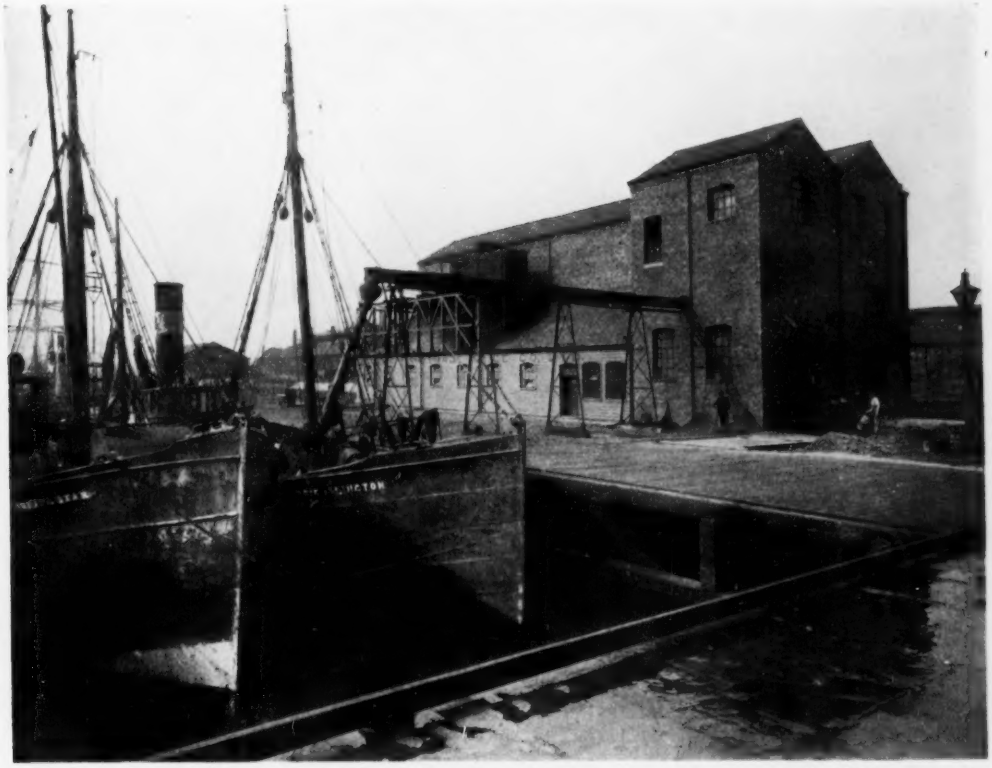

FIGURE. 3.—Trawler taking ice at Hartlepool preparatory to a voyage out to the fishing grounds. (Courtesy of L. N. E. Ry.)

the requirements of the demersal fish port. Fig. 2 shows at a glance which of these are of really major importance. Grimsby and Hull are of the first magnitude, with Aberdeen, Fleetwood and Milford forming an imposing second series. Each of these has its characteristics. In the first place though each and all of them receive trawl catches from all the best European grounds, yet the type of fish caught in their more immediate vicinities is reflected in their individual catches. Thus Aberdeen lands more cod than any other type, North Shields more haddock, Milford more hake. Sole begin to appear in the landings of ports south of Scarborough and skate and ray are important at Fleetwood.

But these ports have other characteristics, more local, more dependent upon the individual history of each. Few ports illustrate more clearly both general and local characteristics so well as Kingston-upon-Hull. It is an old port developed centuries ago, chiefly as an exchange point between the then considerable navigation of the Trent-Ouse basin, and sea navigation. It stands a few miles below the sand banks which have grown up at the confluence of the Ouse and Trent; at a deep-water concave bend in the great estuary; and at the mouth of the most considerable of the little tributary streams. This little opening served as the earliest harbour, but the tide is some 19′ range and in more modern days docks have been built. The first, one of the earliest in the kingdom, was opened in 1780; the last, the splendidly equipped George V dock, was opened in 1914. Now the estuary side is lined with docks, the biggest, deepest and best equipped of which extend on reclaimed land some three miles downstream. Side by side

FIGURE 4.—A "farm" of fish flakes, with drying cod, at Hull. (Courtesy of A. H. Robinson.)

with its development as a great general port, has been the expansion of Hull as a fishing station. It was one of the important whaling ports in the days when that occupation was of consequence in Great Britain. In modern times, the two most westerly of the long line of estuary-side docks have been given up entirely to the fish traffic. These—the St. Andrews docks—as all the others of the port, are now the property of the London and Northeastern Railway Company, which has brought them to a high state of efficiency. Let us review some of the salient features of these fish docks. In the first place they are used by a large type of trawler, for no other port has so considerable an Icelandic connection. The last time the writer visited them he noticed symptoms of two recent developments in our fisheries. Quite the biggest trawler in the dock was a registered Icelandic boat, owned and manned by Icelanders, who perhaps tire of seeing all the fishing fleets of Europe busy on their semidetached block of the continental shelf, and are determined to take a larger part in these fisheries themselves, landing chiefly, of course, at European ports. The great majority of the trawlers using the port, however, are British owned. Now big trawlers making long voyages need large supplies of coal (say 250 tons) and ice (say 50 tons). The dock is equipped with bunkering facilities, with an ice factory, and with ice-shoots. Adequate repairing facilities are required, too. The west side of the dock is occupied by four trawler repairing slips. Boxes and barrels are required in huge quantities. Hull is a great timber port as well as a great coal port, and a box factory occupies a site in the fish dock. The industry produces much fish refuse, and quite a little factory exists in the docks and is concerned with the extraction of fish oil, the preparation of fish meals, and the production of fish fertilizer—the last, by the way, finding a ready market in Japan. More important than any such facilities must be those which ensure the efficient and rapid landing, auctioning, and despatch of the fish. Hull, as one of the chief general British ports, is adequately served by rail routes either to the great London market, or to the industrial districts of North England. Fish cars are brought right down to the fish quays and fast regular fish trains take the catch to Billingsgate or to large inland fish markets.

We see, then, how it is that the modern industry is concentrated at a few centers having specialized facilities. Yet our shores are studded with fishing havens. The little shallow, undredged harbors; the old and inadequate breakwaters; the often hilly hinterland; and the absence of coaling and rail facilities,

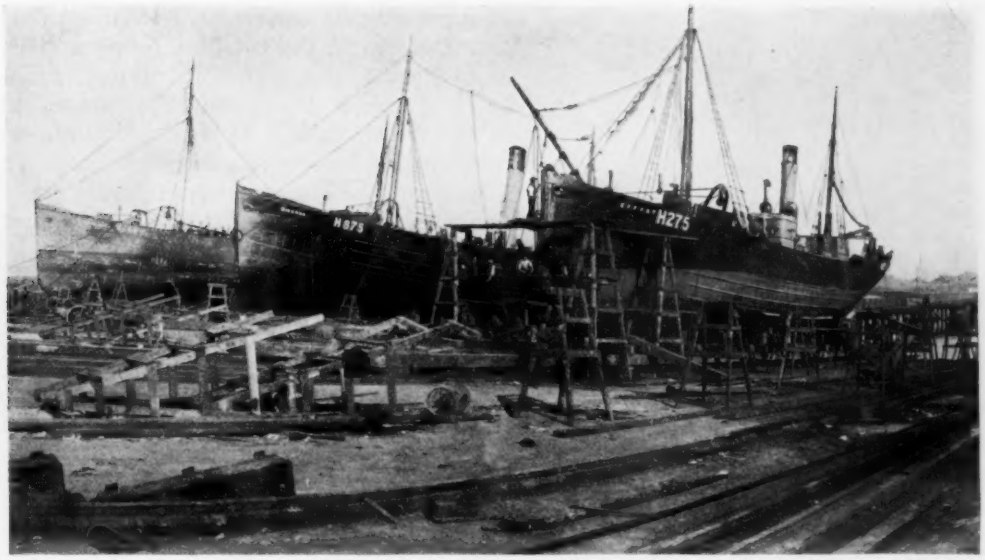

FIGURE 5.—Shipways for trawlers at Hull. These trawlers are large, seaworthy boats. (Courtesy of L. N. E. Ry.)

leave the little places with the one redeeming virtue of the picturesque. Only a little inshore fishing with a local market still remains, and the fisherfolk perhaps earn most of their wage by letting their boats (now often fitted with motors) to the summer visitors; by taking in lodgers; and sometimes by a little auxiliary agriculture. Such spots are vestiges of the days when fish were caught near to the shore and for local markets only. Steam power, the use of ice, and specialized rail transport have changed all that, and have concentrated the industry at large general ports such as Hull (or, on a rather smaller scale, Cardiff), or again at large ports specially designed and equipped for the fish trade, such as Grimsby or Fleetwood. Hull has features in common with the other great demersal fish ports, but it has also characteristics all its own. Its connections with the fish trade are greater than is apparent from the statistics of landings, great though these are. Hull is not generally ranked as a herring port. Statistics show the direct landings of this fish to be few. But if we look at the import figures we have the curious anomaly of a large herring *import* from Norway—curious because *export* is the leading characteristic of our pelagic fisheries. These imported herrings come, loosely packed in ice, in fast vessels from Norway. They are not of the same type, nor are they caught at the same seasons, as the Scotch and North Sea herrings. They are cured and despatched from Hull, however, and serve to increase the fishing activities of the port. Another fish traffic in which Hull is concerned misses the statistics. Billingsgate market, in London, to which we shall make further reference presently, receives a decreasing, but not yet inconsiderable fraction of its fish by sea. Almost all of this is caught by a Hull trawler fleet, which stays for long periods in the North Sea and periodically transhipps its catch, while still at sea, to fast carriers for dispatch to London. Hull has its part too in the oldest branch of the industry. An open space to the west of St. Andrews dock is devoted to the drying and salting of cod for export to Mediterranean and other southern markets.

We have now to consider the pelagic fisheries. These are chiefly concerned with herring. In 1923 herring formed

FIGURE 6.—St. Andrews Dock at Hull, with Fish Market and Shipways. (Courtesy of Aërofilm, Limited.)

94.8 per cent of the pelagic fish caught.

LANDINGS FOR 1923 (MILL. CWT.)

	Herring	*Pilchards*	*Mackerel*
Scotland.....	3.26	0.00	0.026
England, Wales.	3.03	0.069	0.235

Of these the herring shoal seasonally in all the waters surrounding the British Isles, though at different seasons in different regions. The mackerel and pilchard are confined to southern waters and are caught only in the Bristol and English channels. If we would see something of the herring fishery we should go to Yarmouth sometime in the late autumn. Yarmouth owes its existence to the estuary of the Yare—one of the few possible openings on an extraordinarily straight sand-spit coast. Indeed a sand spit, lengthening southward with the prevailing current, has diverted the mouth of the river into a long narrow channel running for several miles parallel to, and one-fourth mile from, the coast. On the narrow spit to the seaward side of this lagoon-like estuary stands the old town of Yarmouth. Picturesque, old, cobbled and extremely narrow passageways abut on wide modern streets, and the sea front is lined with hotels, boarding houses, and the usual paraphernalia of a popular seaside resort. It is just that for Norwich, the neighboring metropolis of East Anglia, which lies almost within sight across the reclaimed marshes to the west. It has its big holiday quota, too, from London, and from the country generally. The railway officials have no sooner disposed of this heavy summer traffic than the time comes for them to take up the burden of the autumn fishing. In October and November, the long eastern bank of the narrow inlet is lined for miles with steam drifters. These are smaller than the average trawler. They are usually about 90′ long, of 18′ beam and about 10′ draught. They carry seven men and one boy. They carry also 70 to 80 nets—rectangular pieces each 55 yards by 6 yards. By joining these they can lay down a continuous wall of netting, some ten miles in length, held up by innumerable floats, and with the upper edge about two fathoms below the surface. The mesh of the net varies according to the size of fish, which are not enveloped in a bag of netting as in the trawl, but are held by the gills in the mesh. For herring the mesh is one inch.

At the height of the season as many as 1,200 of these boats may be working from Yarmouth. Many of them have followed the fishing down from Scotland, where the season is earlier. The railway line is set well back from the wharf side, and the southern end of the spit on which Yarmouth stands is covered with curing houses, storehouses, barrel factories, and barrel storing grounds. One good day in the season at Yarmouth would yield 4,000 tons of herring, or three-fifths of a herring for each man, woman and child of the British Isles! It does not do so, however, for the larger proportion of them are pickled for export. Our great herring industry has been built up on the export trade. It was for this reason practically destroyed during the war. It is only slowly recovering its markets, and it has recently been the deserving recipient of a small govern-

FIGURE 7.—North Sea Trawlers moored to the St. Andrews Docks at Hull. (Courtesy of L. N. E. Ry.)

ment bounty to tide it over the worst period of post-war depression. Yarmouth, then, sends most of its herring out again, though not in quite such overwhelming proportions as is common in the Scottish herring fisheries.

But the autumn Yarmouth invasion is not limited to drifters and their crews. Following the herring fishery down the coast come the Scotch fishing girls, who prepare the fish for pickling and curing. The former, the most usual mode of treatment for export, consists in placing in barrels the cleaned, gutted and salted herring, in layers alternating with layers of salt. After leaving for a period, the pickle is drained off, the barrels refilled with salt, and exported. The method followed is essentially that of the Dutchman, William Beukely, who successfully developed it in the fourteenth century and thereby provided a big factor in the evolution of early Dutch fisheries and sea-power. In the British Isles the pickled herring industry has been expanded by Scottish enterprise, and as a modern industry, it has been fundamentally assisted by cheap supplies of coastal coal. The two other methods of preserving herring produce the kipper and the bloater; but these in smaller quantities and chiefly for the home market. For the kipper the fish is cleaned, salted, opened out flat, and fastened in rows to wooden laths, which, supported on a frame, are hung in the smoke from smoldering wood chips—preferably of oak. The bloater is salted, but not opened out, and is more lightly smoked. It does not keep for long and is not produced in very big quantities.

There is too, of course, a considerable home market for fresh herring. It would be larger if people realized how much greater is the food value of the herring than that of any white fish. It is very rich in vitamines, and of generally acceptable flavor. Herrings are, apparently, simply too cheap for people accustomed to confuse price and value!

FIGURE 8.—St. Andrews Fish Dock at Hull. (Courtesy of the L. N. E. Ry.)

A rather larger proportion of the total Scottish catch is of herring than in the case of England, and the proportion of this, again, which is exported is higher. The catches at important ports appear in Fig. 2.

It is an error to suppose that the fish themselves migrate southward with the fishing season. Herrings of different types, appearance and quality, spawn off different parts of the coast at different seasons. Thus the Manx herring spawns in summer (September) and is fat; the Welsh in winter (November and December) and is poor in fat. The Hebrides fishery (Stornoway) begins in May; the Orkney and Shetlands in June. The fishery reaches Blyth and Shields by mid-July, Grimsby by the end of July, Yarmouth and Lowestoft by early October, and Devon and Cornwall in December. The sparse population and poor inland communication of most of the Scottish stations is of minor importance just so long as the bulk of the catch is for export. The Baltic countries (Russia and Germany)[2] were the greatest markets—markets which are by no means completely recovered after the chaos of war.

The inshore fisheries—at one time almost our only supply of fresh fish—are still represented. The markets are local and desultory and the industry is auxiliary to other employment. A fillip was given to this fishery by the war, when trawlers, drifters, and their crews, were employed by the navy. The off-shore fisheries were dangerous and prices were high. After the war the competition of the larger industry was again felt, and the in-shore fisheries resumed their dwindling status.

Shellfish account for 2.8 per cent of the value of all fisheries of the British Isles. The chief oyster grounds are at Whitstable (Kent) and at Brightlingsea near Colchester; lobsters come from the rocky coasts of southwest England, shrimp most largely from the Wash, and mussels chiefly from the shallows of Morecambe Bay.

One of the outstanding difficulties in the fish trade, as in the case of others dealing with perishable commodities, is provided by the sudden variations in supply. The demand is relatively more stable and proves insufficiently elastic to meet these variations. In this connection we should remember that our rather high per capita consumption[3] of fish is a habit born of a cheap and accessible supply. There is a sufficiency of competing foodstuffs, so that high price over a long period may break

[2] Danzig, Hamburg, Stettin, Riga, Reval and Libau, in that order, are the *chief* continental ports receiving Scottish herrings.

[3] Annual Fish Consumption per Capita: Japan 200 lbs., United Kingdom 65 lbs., Sweden 53 lbs., Canada 30 lbs., United States 16 lbs. (Journal of Geography, May, 1924, page 200, quoted in North America, J. R. Smith, page 96.)

FIGURE 9.—The long Fish Quay of the North Eastern Railway at Hartlepool. (Courtesy of L. N. E. Ry.)

the habit. The disposal of a glut, however, is the usual difficulty. One might have expected cold storage to meet the case, but as a rule, fish do not freeze well. If they are subjected to ordinary refrigerator treatment the flesh is injured by the formation of too large ice crystals. Experience has shown that they can be frozen slowly in brine without injury to the flesh but the appearance for market is badly spoiled. They keep well for days—but not indefinitely—in the pounds of the trawler, smothered in ice, and at a very uniform temperature. On the other hand, deterioration is rapid in auctioning and marketing.

In small country towns the fish retailer receives supplies from merchants at large inland markets, or direct from merchants at the port. The great cities have markets of their own and the greatest of these—indeed the largest in the world—is that of London, and is situated at Billingsgate on the Thames.

Probably no case illustrates so well the difficulties of an elaborate distribution from one great market to a very great number of retailers—difficulties which will be considerable even in a new city where growth is subject to well-planned control, but which are exaggerated in an old city of slow and intricate expansion. Billingsgate is an historical site. It is on the north bank of the Thames just below London Bridge where the river—here called the Upper Pool—is crowded with coastwise and near-continental shipping, and where both banks are completely lined with merchants' wharves. Here was the original harbor of London, just below the little gravel-capped mound which became the original walled City. Billingsgate, below London Bridge, and for a shorter period, Queenhithe above, were, centuries before the days of docks, the little artificial recesses in the river bank which gave shelter and quay-space to shipping. The present fish-market, an unimpressive and inadequate stone building, is crowded among the warehouses of Lower Thames Street. On the river side of the warehouses are their wharves, and Billingsgate itself has its wharves and receives some of its fish by sea. Such traffic was indeed the very origin of the fish market here. It is limited now to the landings of one or two Hull carriers per day (see Fig. 2), landings which can be made direct into the market. Before the war about one-quarter of the fish entered the market in this way. The quantities have since dwindled and it seems as if the water landings might be discontinued in the present state of meagre North Sea catches. Most of the fish now comes in by rail to various London termini. In early railway days these were built on

the outskirts of the town; but the buildings of modern London have long since swept past them, swallowing up some dozens of villages to the north and south of the Thames. Yet London was so large even in the early nineteenth century, that these termini are one and all some distance from Billingsgate. Actually Liverpool Street, which receives fish trains from Yarmouth and Lowestoft is one-half mile away. King's Cross, the terminus for Grimsby, Hull and other fish ports farther north, is two and one-half miles distant. Euston, receiving from Fleetwood, is three miles, and Paddington, from Welsh and south-western ports, is four and one-half miles. The southern termini receive comparatively small quantities. The very greatest amounts, of course, come to King's Cross.

The problem is to get the fish from these termini to Billingsgate and thence to the retailer. It is a problem which involves an apparent pandemonium every morning between 3 A. M. and 10 A. M. The first fish specials arrive at the London termini in the very early hours. The boxes are transferred to horse and motor lorries, most of which belong to the railway companies, but some to private carriers. These go to Lower Thames Street, a narrow thoroughfare running immediately at the back of the Thames-side warehouses, parallel to the river, and at the bottom of quite a steep little hill. There is hardly room for two lorries to pass in what is virtually a slow procession. However, the greater part of the fish never enter the actual market building at all. Fish merchants have stalls in the market and sell much of their fish by samples brought in by porters from the waiting lorries. They rent, too, a number of the ground floor rooms of neighbouring buildings on the land side of Thames Street and use them as extra-market stalls. In effect, the market includes, with Billingsgate itself, a large area of the street outside, and also parts of neighbouring buildings. The fish is bought by auction at the port by port fish merchants, or by port representatives of London merchants, and is sold direct or on commission at Billingsgate. To the onlooker it is something of a miracle that the lorries can be brought near the market at all. There is certainly no room in Thames Street for the retailers' carts. Parallel to Thames Street and at the top of the little hill runs Eastcheap. From a very early hour, retailers' vans and carts of all shapes and sizes, from the roomy motor vehicles of the multiple fish-shops to the pony cart of an East End fried-fish shop, all line up endwise to the pavement of Eastcheap. The transference from the market, or from the waiting lorries, to the retailer's vehicle in Eastcheap, is done by an army of Billingsgate fish porters. They are the real heroes of the fight. They know just where to find both their lorries and their carts, and for several hours every morning of their lives, save Sundays, they twist their way through the maze of vehicles, no more incommoded by pyramids of fish boxes on their heads, than are most men by their hats. By the way, they have hats, curiosities of their calling, shaped like straws, but made of stiff hard leather, and usually shining with fish scales. By 9 o'clock most of the fuss is over. The city streets are filling with their normal day's traffic. The concentration on these great markets (cf. Covent Garden) is only possible, because in the early morning, the streets are free of other business. Occasionally motor transport brings fish direct to Billingsgate from the fish port. This is unusual and occurs only in connection with a few south-coast stations.

At first sight it appears that the market organization which results in such congestion must be inefficient and unnecessarily complicated. But there can be no simple method for the distribution in small quantities, over a vast area, and through various merchants, of a commodity assembled at one place. It would be difficult to devise any more efficient link than the individ-

ual porter in such a transfer. But would it not be possible to have a number of large markets oriented about London and adjoining the great terminal stations? There is much to be said for such a scheme but there are obvious objections also. Such markets could not be simply subdivisions of Billingsgate, more conveniently situated. Each—according to its neighbouring terminus—would have different types, quantities, and qualities of fish. A retailer might have to go to several markets to meet the requirements of his customers—a quite impossible condition. A great advantage of the one central market lies just in the fact that there are to be found every variety of fish landed in Great Britain; and further, only an universal market of this type can attempt to deal with a glut. Then with regard to leaving the present Thames-side site, the possibility of bringing in fish by sea must not be forgotten.

What could be, and what probably will be done, is to relieve congestion by drastically widening and improving the immediate approaches so that a more rapid circulation of traffic may be possible. Such improvement will entail a heavy expenditure, however, because of the high value of land in the vicinity.

Before concluding this brief and inadequate account of a great industry, let us touch on a number of adverse conditions which are effective in this, as they are at the moment effective in all British industry. The purchasing power of Europe as a whole is below par, and the problem has been aggravated by the complex variations in international exchange. The herring export trade was completely wiped out in the war. It is making but a slow and partial recovery. Then the requisites of the industry have enormously increased in cost,—trawlers by 60 per cent, nets and gear by 116 per cent, and, most important of all coal, by 74 per cent. It takes, on an average, 6–7 tons of coal to catch a ton of fish and coal represents more than one-quarter of the total running expenses.

The quantity of fish landed direct from the sea, but in foreign vessels, is increasing—particularly that from Danish and Dutch vessels.

THE REGIONAL GEOGRAPHY OF ANATOLIA

Gordon P. Merriam
Geographer

TO treat Asia Minor solely from the standpoint of economic geography is difficult, because economic geography makes contact with historical and military geography, political and religious geography throughout the land at almost every turn; but Anatolia is worthy of study from any one, or all, of these points of view. It dominates one of the world's great crossroads, comprises such different sorts of country as Asiatic steppe, Mediterranean coast land and Central European forest—finally, it has been a battle and trading ground and a land of passage in all times. Until recent years, however, the economic aspects of this land have received comparatively little attention.

At present, the people of Anatolia are restless and unhappy under the impact of western material civilization. It were well to know with what we have to deal. Surely one question that requires an answer in regard to human life in any area is: How do the people make a living? A second question, equally important, then presents itself: Why do they make their living as they do? In this paper the attempt is made to answer these two questions on the basis of the available information. For the sake of clarity, the discipline of regional treatment has been applied to this paper in the endeavor to answer these questions on the basis of information available.

Asia Minor may be divided into (1) a Region of Mediterranean Agriculture, (2) a Region of Pastoral Nomadism, and (3) three Regions of Forest Exploitation which are alike in most essential respects.

THE REGION OF MEDITERRANEAN AGRICULTURE

Economically, the Region of Mediterranean Agriculture is the most important in Asia Minor (Fig. 1). In density of population, in the richness, variety and quantity of its products, in the size and scope of its commerce with the outside world, this region ranks above the others, and mining and manufacturing interests attain a significance that they fail to reach elsewhere in Asia Minor.

AGRICULTURE

" . . . Mediterranean man's greatest achievement is that he has, wherever this is possible, replaced the natural vegetation by a series of crops which make use of every drop of water, every square foot of soil, and yield him a complete dietary."[1] Restricted rainfall, restricted cultivable land, intensive agricultural effort—such is the genius of the bordering Anatolian lands.

It is common knowledge, however, that the region is by no means exploited to the highest possible pitch. The reasons for this state of affairs are complicated and lead outside the scope of economic geography. It is enough to say that political disturbances, internal and external, have been responsible.[2]

The great trouble with the Mediterranean climate for agriculture is that the rainy season and the cool season coincide—most of the moisture comes when vegetation is dormant. The hot season and the dry season likewise coincide—admirable for ripening the drought-resistant grains, but prohibitive of the continued growth of vegetables. Spring and fall, when the sun is fairly hot and the rainfall fairly abundant, are the periods of greatest vegetative activity.

[1] M. Newbigin: "The Mediterranean Lands," New York, 1924, p. 63.

[2] "We have . . . to think of the Mediterranean type of cultivation as remarkably productive where it can be carried on continuously without serious interruption; but at the same time as so poised that even minor disturbances have far-reaching consequences." *Ibid.*, p. 65.

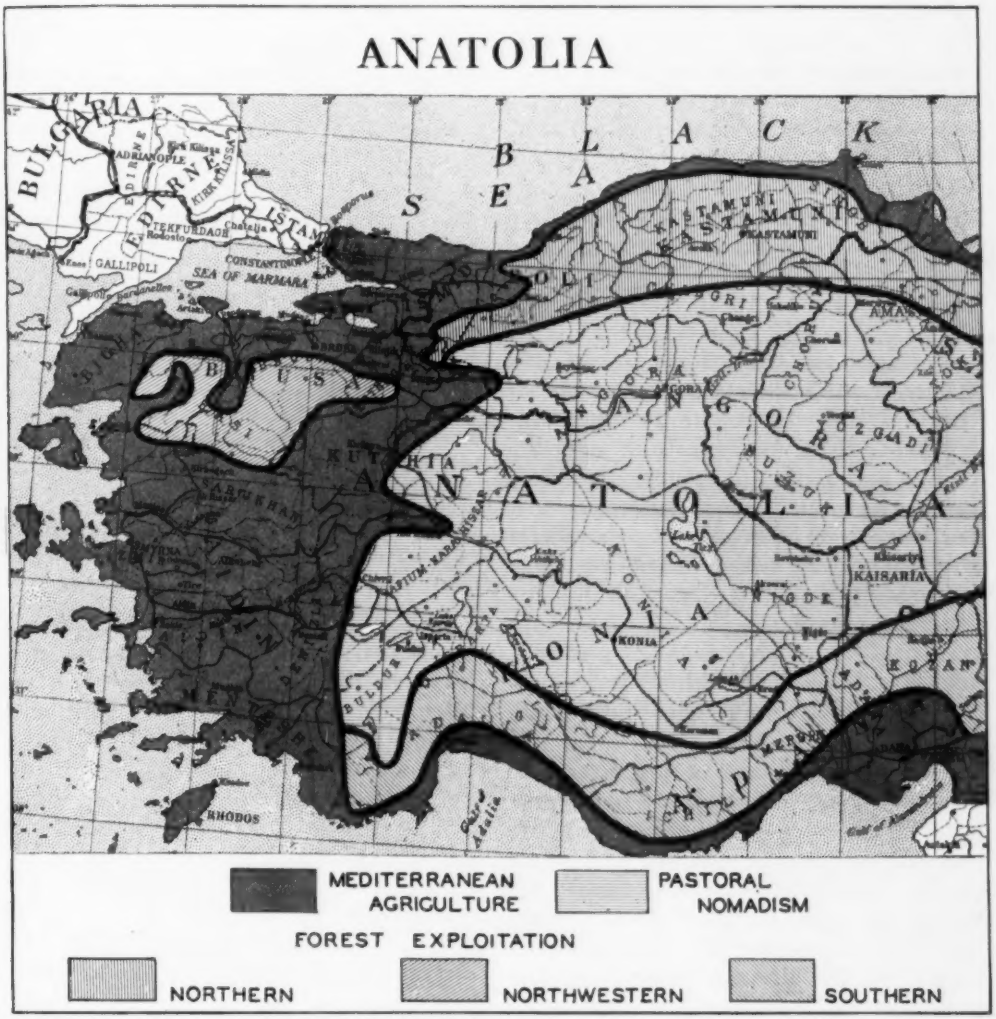

FIGURE 1.—The major agricultural regions of Anatolia. Their extent and distribution are consequent upon physiographic and climatic factors.

In the west, the region consists of hills and mountains divided into blocks and stringers by plains; in the north and south, it comprises deltaic plains of varying size, isolated from each other by outliers of powerful mountain ranges. High relief forces agriculture to the broad valley bottoms and to the valley slopes. The lowland on the topographic map coincides in the main with the cultivated land on the map of land utilization.

Only general information is available in regard to the soils of the region. The residual material is so thin that it is little used for agriculture. It is chiefly on two sorts of soils that agriculture is possible, both of them alluvial, both of them fertile. One is of medium texture and well drained, the other consists of heavy alluvium retentive of moisture. "The fact that the seasons of heat and of moisture do not coincide retards the disintegration of the rock, and soil is formed slowly. On the other hand, in consequence of the violence of rainstorms, there is much erosion. Thus deforestation, or the neglect of cultivation, often leads to an extensive wast-

age of the available soil."[3] The alluvial flats of this region represent, in fact, the soil of most of Asia Minor.[4]

Towards the interior, agriculture gradually loses its importance. The border of hill and mountain country force the damp sea winds to rise, cool, and condense their moisture. The abundant precipitation results in forests, so dense in the north and south, where the mountain chains rise higher and more abruptly than they do in the west, that activities based upon the forest form the basis of economic life within a few miles of the coast. In the west, where the mountains are relatively low, where the proportion of hill and mountain country to plain increases gradually eastward and where, because of its accessibility, the forest cover has been widely removed, agriculture gives way to pastoral pursuits ultimately dominant.

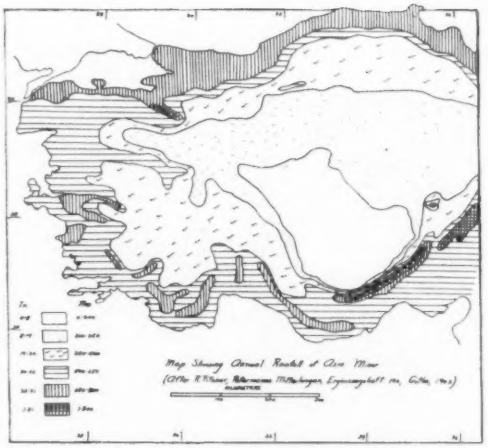

FIGURE 2.—The distribution of rainfall in Anatolia coincides so closely with the agricultural regions that the climatic control is obviously dominant, though of course even the climatic divisions merely reflect the effect of the physiography upon the seasonal winds.

CEREAL PRODUCTION

The grains are the most important crops of the region. The available statistics are difficult of interpretation because they are based upon large political divisions, and because they are generally inaccurate; but it seems safe to say that in this region, where the grains compete for land with several highly important money crops, the percentage of the cultivated area devoted to cereals is not less than 80 per cent.[5]

Wheat and barley are of much greater consequence than the other grains. Sown in the fall, at the earliest in the later part of September, they germinate during the autumn rains. Low winter temperatures stop growth before the plants grow much, but as soon as spring comes they grow quickly, watered not only by the spring rains, but also by the seepage water from the storms of winter. The grains ripen under the hot sun of late spring and early summer. Harvesting takes place between the end of May and the last of August, the time varying with the locality. Methods of cultivation are very simple except on a few farms where modern methods have come into use. The land is scratched with a wooden plough and the seed broadcasted. Threshing is carried out on hard-packed earthen floors.

The rice crop is not adequate to the local demand, for rice ranks with bread in the diet of the Anatolian. It goes without saying that the rainfall is hopelessly inadequate for rice culture and since opportunities for irrigation are either lacking or unutilized for the most part, cultivation is carried on only in a few restricted areas covered by stagnant water. Though rice is a very profitable

[3] Anatolia: Handbook Prepared under the Direction of the Foreign Office, No. 59, London, 1920, p. 6.

[4] " . . . the rivers . . . have to force their way through the crumpled northern and southern edges of the plateau, in some cases flowing for a long way westward before finding transit. . . . The rapidity of their final descent causes them both to cut very deep beds . . . and also to carry down, without chance to deposit it, the immense spoil of the powdery higher lands to the alluvial flats bordering the sea. Thus have been formed deltaic tracts out of all proportion to the water discharge of many of the streams, for example the Kizil Irmak, the Gediz-Chai, the Greater Menderez, and the Sihun-Jihun." D. Hogarth: "The Nearer East," New York, 1902, p. 92.

[5] Based on Turkish Government figures for 1909–10, cited in E. F. Nickoley's chapter on agriculture in E. G. Mears, "Modern Turkey," New York. 1924, p. 285.

crop, the low, marshy situations in which it is grown are so unhealthful that the government at one time forbade its cultivation in the most productive rice area of the region, the plain of Brusa, where the ravages of malaria were most fatal.

Other grains are widely distributed in the cultivated areas of the region, but their importance relative to that of wheat, barley and rice is negligible.

TOBACCO PRODUCTION

Among the crops of the region tobacco ranks in importance next to the grains and in money value first. Statistics for domestic consumption are lacking, but it is undoubtedly very great. The value of the overseas export, although varying greatly from time to time because of political and military troubles, has in a single year reached the sum of ten million dollars.

All varieties of Turkish leaf are used solely for cigarettes. The peculiar conditions of soil and climate which give to Turkish tobacco its aroma, its qualities of burning and blending, are not known. Attempts have been made to grow Turkish tobacco in other lands—Samsun tobacco has been tried in America, for example, where the experimenters went "even to the length of sending over quantities of Samsun soil in which to start the plants"[6]—but without success. The aroma of Turkish tobacco constitutes the reason for its desirability. The one foreign-grown tobacco that is extensively used in the American cigarette industry is Turkish.[7]

The tobacco lands are well fertilized. The seed is sown in March and transplanted in May or June. The lower, less valuable leaves are gathered in middle and late June and the harvesting lasts into September, when the upper and best leaves are cut.

[6] W. J. Childs: "Across Asia Minor on Foot," New York, 1917, p. 12.

[7] C. A. Werner: "Tobaccoland," New York, 1922, p. 228.

Werner [8] gives details concerning the tobacco districts of the region.

1. Samsun is the most important producing center of Asia Minor. The quality of the leaf is second only to that produced about Xanthi and Kavalla in Macedonia.

2. Baffra and Alatzamion are noteworthy districts, Baffra leaf in particular being famous for its exquisite taste and aromatic quality.

3. The tobaccos of Sinope, Ineboli and Zunguldak are low in quality but are produced in considerable volume. Climatic conditions nevertheless are about the same as those under which Baffra and Samsun tobaccos are grown.

4. The Ismid tobacco district is one of the most important producers of the region, although the quality is not high.

5. Smyrna tobacco has a particularly fine taste and is highly desirable for blending. "It is said that without the mixing of some Smyrna tobacco a good cigarette cannot be manufactured."

OLIVE GROWING

The importance of the olive tree in Asia Minor has been underestimated, probably because olive products from this area do not enter into overseas exchanges in a large way; the olive is essential to the economy of coastal Anatolia, for in this rather densely populated region the olive plays the same part in the diet of the inhabitants that the butter and animal fats play in the diet of northern peoples. The olive production ranges between 150,000 and 450,000 tons a year.[9]

The tree grows without irrigation in districts with not less than eight inches of winter rainfall. This requirement is met throughout the region. That no artificial watering is required is an advantage to the grower since overwatering

[8] *Ibid*, pp. 235-6.

[9] Consul General G. B. Ravndal: "Trade and Economic Review for 1922," No. 35; Supplement to Commerce Reports. United States Bureau of Foreign and Domestic Commerce, Washington, 1923, p. 27.

diminishes the quantity of the oil, and in lands where irrigation is necessary it must be done with care. Summer rains are undesirable for precipitation during this period, when the fruit is developing, is injurious. Only with great care is the fruit brought to maturity on the Black Sea coast, where the summer rains are considerable.[10] Elsewhere in the region the summer rainfall is slight and causes little or no trouble.

The trees can stand fifteen degrees of frost if the cold comes on slowly, but in the spring even a light frost is fatal to the crop. The tree is not grown, therefore, at altitudes where severe spring frosts are likely to occur. On the Black Sea coast near Samsun and on most of the Marmora shores, the olive is planted to a height of nearly 1,000 feet. Between the southwest corner of the Bithynian peninsula and Sinope, however, the tree does not grow at all, probably because this particular stretch is unprotected from the cold northeast winds of the Russian steppes, whereas the coastline to eastward is sheltered by the distant but apparently effective mountain wall of the Caucasus. In all historic time the Scutari-Sinope strip has not supported the olive, whereas, so far as known, the tree always has been grown along the coast to the south and east. On the west coast the trees reach an altitude of 1,300 feet on southerly exposures. In the western valleys on north-facing slopes the tree grows to 1,000 feet; on the south-facing slopes to 1,600 feet. In the interior sections of these valleys it fails to flourish above 800 feet. On the mountain slopes which overlook the hot Cicilian plain the tree is found at 2,100 feet.

The olive is planted most at intermediate elevations. Although the tree grows to a greater size on the rich, deep, damp soils of the alluvial plains and deltaic tracts, the best and the greatest quantities of oil come from the trees which are grown in the cultivated groves on the warm, dry, porous, limey soil of the valley, and lesser mountain slopes.

The olive crop is harvested in November and December, but the fruit lies in heaps until it has been assessed by the tax-collectors. It is then salted to prevent too much decay. Consequently the olive products of the region are not in general of high quality.

Scattered data concerning the importance of olive culture in the various sections of the region are available. The olive is unimportant on the Black Sea coast about Samsun, probably because the rather abundant summer rainfall prevents a heavy yield. Here the annual production is about 14 short tons.

On the south coast of the Sea of Marmora the tree is of more consequence. Between Gemlik and Panderma (about sixty-five miles) are 400,000 trees in full bearing. In the plain of Brusa alone 2,500 tons of oil are expressed yearly. To the west the strip widens. On the plain of Troy and about the Gulf of Edremid the olive is the most important fruit. Although about Smyrna the olive has less relative importance, the crop amounts to 22,000 tons of olives worth three-quarter million dollars. The province of Aidin, of which the olive center is Nazilli, presses 7,000 tons of oil worth from a million to a million and a half dollars.

The southwest coast is also of interest, but Cicilia, in the east, is no olive land. Isloated trees are planted in the plain and on the mountain slopes. There are plantings, however, to the north of the Gulf of Alexandretta covering an area of 38 square miles.

COTTON CROP

The cotton production of the region varies greatly—from 150,000 bales in 1912 to 45,000 bales in 1916. Before the war the harvest showed an annual increase, due chiefly to increasing demands from western Europe. During the war, however, cotton-growing received a severe setback, partly because

[10] This and much other information concerning the olive from T. Fischer: "Der Olbaum: *Pet. Mit.*," Erg. 147, Gotha, 1904.

some of the cotton markets were no longer open, partly because of the restriction and disorganization of transport, and partly because some of the cotton-growing districts were almost deprived of harvest labor. The cotton-growers of the region depend largely upon casual laborers from Armenia and eastern Anatolia to harvest the crop. The men who come into the Cilician Plain to seek this sort of work normally number more than a hundred and fifty thousand each year. Since the war, production has recovered to such an extent that shipments to Europe are again being made.

Cotton production takes place chiefly in two districts, the Cilician Plain, and the plains of the west.

The Cilician Plain

The temperature conditions of the Cilician Plain resemble those of the lower Nile Valley. The summer is excessively hot, and favorable for cotton. A shade temperature of 113° is not rare, and at night there is no notable cooling.[11] The summer drought is very marked, though not so severe as in the valley of the lower Nile. South winds from the sea and from the swamps which border the plain carry moisture to help supply the water requirement of the plant. The high relative humidity of this wind makes it very oppressive. In addition to moisture it bears flies and mosquitoes, hence fever, from the marshy border-tracts; consequently everyone who can do so moves to the mountains for the summer months. Cotton would grow much better on the plain with irrigation, but save in a few isolated places irrigation is not practised.[12]

Three soils have been recognized in the plain, a black soil rich in humus; a gray soil, its color probably due to a relatively high chalk and lime content; and a red-dish loam. All of them are suitable for cotton, fertile and retentive of moisture.

Ninety-five per cent of the cotton grown is the short staple variety known as "Jerly," probably native to Syria and northern Arabia, and able to grow with little water. It is produced by a system of three-field rotation. Grain is grown the first year. In the second year cotton is planted either alone or with sesame, or sesame is planted alone. In the third year the field lies fallow, though in places pastured. The cotton is sown in March or April and harvested in October. In the case of mixed crops, the sesame ripens one month earlier than the cotton. Because the sesame seeds draw so much nutrient material from the soil that the amount and quality of the cotton fiber is much reduced mixed cultivation is gradually being given up. Similarly watermelons are grown with the cotton, but since the water content of this fruit is about 80 per cent, the amount of moisture available for the cotton is cut down.

Shortness of fiber is the chief trouble with the "Jerly." Attempts to grow American and Egyptian cottons and to improve the quality and productiveness of the "Jerly," have been made for the most part under the stimulus of the Deutsch-Levantinische Baumwollgesellschaft, which was active before the war. Although the company succeeded in increasing the yield of the plain from 75 pounds to the acre to 90 pounds, the experiments achieved only a partial success. Before Turkey entered the war the crops would have been much better than they were but for certain unexpected, though perhaps not unusual, catastrophes. Once hail damaged the cotton. At another time a cloudburst mudded down the greater part of the crop. At still another time a swarm of locusts left scarcely a stalk standing in many parts of the plain.

Smyrna District

The production of the Smyrna District is smaller than that in the Plain of

[11] E. Banse: "Die Türkei," Brunswick, 1919, p. 174.

[12] This and most of the material on cotton is from W. F. Bruck: "Probleme der Weltwirtschaft," 29, Türkische Baumwollwirtschaft, Jena, 1919.

FIGURE 3.—The harbor of Trebizond from which much of the produce of the eastern part of the Black Sea coast of Asia Minor is exported. (Courtesy of the Near East Relief.)

Adana. As in the latter, the "Jerly" is the predominant variety, but a somewhat larger proportion of the cotton—10 per cent—comes from American plants.

The cotton is grown on the alluvial plains of the three large west-flowing rivers, the Gediz, the Kutchuk Menderez and the Biyuk Menderez. The finest cotton comes from around Aidin. None of the plantings are more than sixty miles from the sea, for beyond that distance the moisture brought by the summer sea winds is not sufficient for the plants. Heavy dews aid the cotton to secure enough moisture despite the summer drought.

The "Jerly" of Smyrna is better than that of Cilicia. In color and gloss it resembles high-priced Egyptian cotton. The value of the Egyptian and American plants for the Smyrna area has not been determined, but both must be watered and both plucked before the fiber falls to the ground. The Egyptian variety may not ripen before the autumn rains set in. The yield of cotton is much higher here than in the plain of Adana.

FIG PRODUCTION

Fig culture is one of the major agricultural pursuits of the region. Part of the fig output is consumed fresh and part is dried; the dried figs are exported in large quantities. The total output of figs in 1912–13 was estimated at 770,000 short tons. Customhouse returns at Smyrna, the only town with a dried fig export of any consequence, valued overseas shipments in 1912–13 at nearly three million dollars. The average normal crop of figs in the districts tributary to Smyrna is about 20,000 tons. Fresh figs are consumed to even greater extent.

The fig tree grows along the littoral of Asia Minor, its distribution practically coinciding with that of the olive. Only from the valley of the Biyuk Menderez is the fruit sent to foreign markets, but in this plain, probably the richest of the region, the dried fig constitutes the most important article of export.

Cultivators the world over prefer the Smyrna fig tree because of the flavor peculiar to its fruit, due to the number of ripe seeds which the fig contains. The tree differs from all other varieties of fig in that "its crop of fruit is absolutely dependent on a fertilizing insect," hence the production of the fig is dependent not only upon natural conditions suitable for the tree itself, but is further confined "to regions where the winters are suffi-

FIGURE 4.—Ages old threshing system still used in the Anatolian grain districts. (Courtesy of the Near East Relief.)

ciently mild to permit the . . . winter insect-bearing crop to live through without injury." [13]

The insect is able to endure 14 degrees of frost and the tree slightly more. It is only rarely that the temperatures of those parts of the region which grow the fig approach the danger point. The tree is also resistant to the heat and drought characteristic of the region. To dry the figs, high temperatures, low relative humidity day and night, and continued fair weather are the prime desiderata. There is no doubt that the Biyuk Menderez Valley is hot enough, but the area has heavy dews at night throughout the summer months.

GRAPE PRODUCTION

The grape is grown throughout Anatolia and is produced in prodigious quantities. An estimate for 1922–23 gives 880,000 tons. The normal production of Sultana raisins in the areas which export through Smyrna is over 37,000 tons. The fruit is consumed fresh, made into wine—chiefly on the coasts for consumption by non-Turks—and dried. The distribution of the raisin industry is known only in a vague way, but it is carried on chiefly in localities which have two advantages: proximity to the export facilities of the seaboard, and climatic conditions during the drying season which approximate those of the Biyuk Menderez Valley where the fig is dried. It is probable, therefore, that the grape is dried for export only in the Region of Mediterranean Agriculture. The importance of the raisin industry must be considerable, although information in regard to it is scanty. From Smyrna, in 1911–12, dried raisins were exported to the value of nearly five million dollars.

Beside the grape products already mentioned, another of great importance must be added—pekmez—which is unfamiliar to the west. Pekmez is prepared by the Turk, whose religion forbids the use of wine, but whose land produces the grape without stint. "Pekmez is grape juice, boiled, and then prepared by beating, which changes it from a thin watery fluid to a thick partially crystallized substance like clouded honey, but nearly as dark as treacle. These methods are fairly obvious; the curious part is that the beating must be done with the open hand, and nothing else. Pekmez cannot be made by beating with wood, or bone, or metal, so it is said. Once the beating has begun it must go

[13] G. P. Rixford: "Smyrna Fig Culture," Bull. No. 732, United States Department of Agriculture, Washington, 1918, p. 31.

FIGURE 5.—Modern methods of western agriculture may revolutionize the entire economic life of the Near East, particularly in those regions where machinery may be used. (Courtesy of the Near East Relief.)

on to the end without ceasing, or the pekmez will be spoiled—there must be no cessation of blows at all. After the grape harvest, therefore, Turkish towns and villages resound with the making of pekmez. All day, all night beating goes on. The process is long—so long that the women and girls take turns at the work, and beat until their hands are blistered and painful. It is said that sometimes the beating lasts a day and night.[14]

STOCK-RAISING

Stock-raising in the region is second only to agriculture. No statistics are available, to show how stock-raising compares with other activities either in value of products or number of people engaged.

The livestock industry of the Region of Mediterranean Agriculture differs from the industry as it is carried on in the interior in two important respects. Nomadic stock-raising as practised on the steppe does not prevail here owing to the relative abundance of pasture. Many of the animals raised in the seaward region, such as cattle and water buffaloes require rather abundant pasturage.

Stock-raising is semi-nomadic in that while those who engage in the industry are not settled, they are not continually on the move, but change their habitat according to the season. During the damp, cool winter, when the mountains are capped with snow, and when pasturage on the plains is abundant, the tents of the herdsmen are pitched in the valleys close to the towns. In the spring, when the lowland grass begins to wither in the increasing drought and mounting heat, the herds are driven to the elevated pastures, whence they return only at the reappearance of snow on the heights, a capital instance of transhumance.

There is a large amount of land suitable for seasonal pasturage. Plain and mountain alternate in almost interminable succession in the west, where semi-nomadic herding is most extensively developed. But a similar procedure characterizes all parts of the region in the north and south between the highlands which rise from the delta plains and the plains themselves.

The Cilician Plain, for example, is pastured in winter over the areas that are uncultivated or lying fallow. Where this plain rises towards the mountains a considerable tract of land is grown over with tall grass and bush; a paradise for hunters in summer, it forms in winter

[14] W. J. Childs, *op. cit.*, p. 70.

FIGURE 6.—The grain fields of Anatolia may once again furnish food for all its people, and may even export some grain. Political security is the first prerequisite to a reëstablished agriculture. (Courtesy of the Near East Relief.)

a rich pasture ground, particularly for sheep, which here produce the finest quality of wool, but also for water buffaloes, horses, goats, and donkeys. The summer pastures for the whole Cilician area lie on the slopes of the mountains to the north of the plain.

The mountain slopes adjacent to the plains were originally everywhere covered with forest, but this has been denuded wherever the trees were accessible. The cut-over land is now utilized for grazing. Many of the hills and mountains, particularly those of the west, are flat-topped, and level pasture land.

The plains, although utilized in part for agriculture, nevertheless comprise large tracts used for grazing. The rivers flow at grade in wide, shallow channels, depositing sediment. As might be expected in the lower courses of rivers of which the basins lie under a marked seasonal regimen of rainfall, these streams become torrential in the rainy season and overflow their banks along the lower courses. Thus along the rivers strips exist within which, because of seasonal flooding, settled agriculture is out of the question, but which furnish rich pastures during the late autumn, winter, and early spring months. In the valley of the Biyuk Menderez, perhaps the richest agricultural district of Asia Minor, an English engineering firm has estimated that by controlling the course of the river and by utilizing its waters for irrigation, one million acres of new land could be brought under cultivation. Tracts of this sort are now utilized for pasture.

MINING

Mining, not of great consequence as compared to some other activities of the region, is, nevertheless, of peculiar interest, because the mines produce several ores of which the world supplies are limited.

"The following statistics of the output in 1910–11 of the principal minerals worked in Anatolia are based on Turkish official statistics, revised and amplified by a German expert. They are, nevertheless, only approximately correct, falling short in both completeness and accuracy. . . . "[15] Since most of the mining of Anatolia is carried on in the Region of Mediterranean Agriculture, the table may be taken as showing, by

[15] Anatolia: Handbook, etc., No. 59, pp. 81, 82.

and large, the mineral production of that region.

TABLE

Mineral	*Output in Metric Tons*	*Value in Dollars*
Coal	766,392	1,700,000
Lignite	41,226	70,000
Chromite	16,604	166,000
Emery	27,656	441,000
Pandermite	11,352	368,000
Meerschaum	115	299,000

Of these, chromite, emery and pandermite are minerals which are rare except in a few localities. Meerschaum enjoys a monopoly, since no deposits other than the Anatolian are known.

COAL

The best coal fields are located to the east of Heraclea on the Black Sea coast. They produced, in 1912, nearly 70 per cent of all the coal mined in Anatolia. Production in one year reached a total of nearly a million tons. Light railways have been built to the coast and at Zunguldak harbor works have been constructed. In 1912, 42 per cent of this coal was sold for bunkering at Zunguldak and 36 per cent was marketed in Constantinople.

The extent of the seams has not been determined, but one of the more important formations is known to be three miles wide and at least 95 miles long. The coal of the basin may be divided into two main parts on the basis of quality. The first, a greasy coal, makes good metallurgical coke and can be used in the manufacture of gas; the second, a dry coal suitable for domestic heating, is used under boilers, and can also be used for making gas. The beds which contain the first variety of coal (Cozlou) have been the more actively worked. The deposits consist of about thirty seams of which twenty-five have a thickness greater than thirty inches. This coal can be compared to that of the Sarre Basin. The second (Alladja-Aghzy) formation has a total thickness of about 980 feet of which from forty to fifty feet consist of coal, divided into fifteen seams. The maximum thickness reached by a single seam is about ten feet.[16]

"In the Vilayet of Aidin coal is mined near Soma for the use of factories in that neighborhood and at Bergama. At Sokia and Nazilli in the Biyuk Menderez Valley are workings which supply local needs; and at Makri a mine produces coal of good quality."[17]

SILVER–LEAD–ZINC

The most important silver-lead-zinc mines are located near Balikesri. This development is, or was, the most prosperous mining enterprise in Asia Minor. It has been operated by the French along the most modern lines, and from 1910–1913 "the dividend paid on its share capital averaged 23 per cent per annum."

CHROMITE

The Region of Mediterranean Agriculture ranks with Greece and Russia as a chromite producer. New Caledonia is at present the world's most important source of this mineral and the three areas first mentioned rank second, third and fourth, their positions changing from year to year. From 1870 to 1900 the Anatolian area supplied most of the world's chromite, but increasing competition from New Caledonia has forced the closing of many mines in the region.

The chromite deposits actively worked are located near Brusa, Kutahia, Makri and in the neighborhood of the Gulfs of Adalia and Alexandretta. Most of the ore comes from an area between Brusa and Kutahia on the south and southwest slopes of Mount Olympus, and from Makri. For many years, it is said, the Brusa and Kutahia deposits yielded 20,000 tons annually, of which one mine (the Daghardi, near Kutahia) furnished nearly three-quarters. "This deposit consists of high-grade ore . . . and has

[16] L. de Launay: La Géologie et les Richesses Minérales de l'Asie," Paris, 1911, pp. 295, 296.

[17] Anatolia: Handbook, etc., No. 59, p. 87.

been estimated to contain about 10,000-000 tons. . . . "[18]

MEERSCHAUM

The meerschaum of Eskishehr monopolizes the world market, although deposits have been noted near Angora and Tarsus.

The basin in which the meerschaum is found "belongs to the government. Upon securing a permit, the people of this locality can open pits and extract meerschaum on their own account. There are, at present, nearly two thousand pits. . . . There is no machinery of any sort, no pumps, and no woodwork of any kind exists in these pits. The depths of the pits vary from sixty-five to two hundred feet. Below the latter depth operations are rendered difficult by ground-water. When the layer containing meerschaum is reached, horizontal galleries are opened and the meerschaum is dug out and removed from its jacket. . . . The stones are first brought to Eskishehr, where they are dried, weighed and to some extent polished, and, after being sorted, they are packed in cases and shipped to Vienna where they are worked."[19] The handling of the meerschaum even before it is sent to Vienna is complicated, and the methods in vogue have become customs through long usage.

EMERY

A number of deposits in the Vilayet of Aidin furnish the chief source of the world's supply of emery. For the finishing and polishing of glass, particularly optical glass and plate glass, it is probable that no satisfactory substitutes are available for the better grades of Turkish and Greek emery.[20] Turkish emery is somewhat softer than what is mined in Naxos and is in greater demand, partly for this reason and partly because it is cheaper. Statistics show that natural emery has not suffered from competition with artificial abrasives. "The artificial products, in fact, are higher in price, and are used to supplement the natural supply."[21]

The deposits lie in the west of the region, the richest of them between Tire and Sokia, others at Nazilli and near Mughlat.

PANDERMITE

Pandermite (boracite) is exploited near Susigirli, about thirty miles south of Panderma.

SUMMARY

It is worth noting that with very few exceptions the mines are located either on or near the coast, or else on or near lines of communication to the coast. The circumstance is not surprising, for two reasons: (1) deposits so located are more apt to be discovered, rediscovered and investigated by both inhabitants and foreigners than deposits in inaccessible places; (2) since comparatively little of the mineral production is utilized in the region, the overland haul to the seaboard often becomes a prohibitive item of expense, and the shorter and easier the route, the better. It is interesting to speculate, for example, what degree of development the coal fields of Heraclea would show at the moment were they located not on the coast, but at some interior point such as Afium Karahissar.

The characteristics of the main mineral products, in view of the fact that they are sold abroad, are of considerable interest. These products appear to fall into two categories: (1) those which meet with stiff competition in the world market but which are sold at a profit either because the mineral is located almost "on top of the market" (Heraclea coal), or because the deposit is unusually rich (argentiferous lead at

[18] E. C. Harder in J. E. Spurr: "Political and Commercial Geology," New York, 1920, pp. 115–117.

[19] Jemal Bey in E. G. Mears, *op. cit.*, p. 321.

[20] F. J. Katz in J. E. Spurr, *op. cit.*, p. 356.

[21] Anatolia: Handbook, etc., No. 59, p. 91.

FIGURE 7.—Shearing time on the uplands of interior Anatolia where great herds of sheep are grazed. (Courtesy of the Near East Relief.)

Balia Maden); (2) those which, because of limited world supply, have to meet little or no competition.

On the other hand, the deposit of a mineral in which competition is keen, a deposit which has no definite advantage of location or of quality, is not worked in any important way.

Accessibility of the ores of the region to sea highways gives life to the exploitation of rare or otherwise advantaged minerals, but, through lack of a steady domestic demand, this accessibility prevents the exploitation of those minerals which, so to speak, cannot compete in the markets of the world with the dice loaded in their favor.

FOREST EXPLOITATION

Activities related to forest resources are of no great consequence in the region, but they are of more importance than is generally suspected. The forests of the Province of Ismid occupy no less than 41 per cent of the total land area, those of Bigha 30 per cent and those of Aidin, economically the most intensively developed province of Asia Minor, 9 per cent.

The forests occupy rough, high, steeply sloping land. Wherever accessible they have been cut off; nevertheless large areas are hard to get at because the topography is difficult and because transportation facilities are relatively undeveloped, and the wood in such areas has remained almost untouched. In such elevated situations the trees secure rather abundant rainfall, and the season of drought is less marked than upon the neighboring plains.

"The forests of Turkey consist of several kinds of pine, larch, several species of oaks, chestnut, beech, basswood, sycamore, elm, poplar and alder."[22]

The forests are utilized in four ways: the wood is used for building purposes (including cabinet-making), for conversion into charcoal, for firewood; and finally acorn cups of the valonia oak are gathered and expressed to yield extract for tanning.

In a few places hydraulic and steam sawmills have been erected, but the wood industries as a whole are conducted on a small scale. The streams are utilized to some extent to float the logs to the seacoast or to points on the railroads.

Admirable laws designed to regulate forest exploitation have been promulgated, dating back as far as 1870, but

[22] Zon and Sparhawk: "Forest Resources of the World," New York, 1923, Vol. I, p. 491.

since they have not been enforced, timbering nowhere is conducted on a scientific basis save in the forest of Eshelek in the Province of Bigha, which has been under the control of the School of Forestry near Constantinople.

MANUFACTURING

The manufactures of the region do not bulk large in value or in output, but whereas in the other regions of Asia Minor manufacturing is practically nonexistent, except for home industry, manufacture on a modern scale has reached some development in the Region of Mediterranean Agriculture.

Manufacturing is based on the resources of the region and its hinterland. Like the products of the mines, the products of manufacture consist primarily of comparatively scarce articles such as rugs and raw silk in heavy demand in western countries. Certain subsidiary manufactures, such as the weaving of cotton backing for rugs, have also grown up. Finally, production of special articles is considerable, like the fez and certain coarse clothing in demand in the local market alone and not encountering competition from the west.

Carpets constitute the chief manufacture. At Hereke on the Gulf of Ismid a State school of carpet-making produces a small number of very beautiful carpets,[23] but the great rug district is centered about Smyrna. Most of the rugs are hand-woven by women and girls who work at home. The merchants of Smyrna (chiefly British) who are interested in this industry have established spinning mills in the district from which they supply yarn of good quality to the weavers. The wool is clipped from the sheep raised in the vicinity, and from sheep driven in for slaughtering from the lands to the east. Over 60,000 people, before the war, were working on carpets for the merchants of Smyrna alone. At Geurdiz, Kula, and Ushak the rug industry is also important, although it lacks the degree of organization which characterizes the business at Smyrna. The growth of modern rug manufacture in recent years is brought out by export statistics. In 1901, rugs worth $1,400,000 were shipped from Smyrna; in 1910 the value of these shipments reached $3,600,000. The present condition of rug manufacture is not known, but it is not likely that it has yet recovered from the destruction of Smyrna in the autumn of 1922 and subsequent dislocation of the population.

Textile manufacture includes the making of rough cotton, wool, and silk goods. Silk is produced at Samsun, but no details of production in that area are available. Near Ismid two government factories make uniforms for the army and navy. Brusa produces silk. "There used to be much silk-weaving in the district, but, owing to disease among the silkworms some forty years ago, this branch of the industry almost disappeared, and recovered only very imperfectly when the disease was eradicated and the production of silk again increased. At present the manufacture of silks is mainly a domestic occupation. In connection with the silk manufacture, a cotton industry of some importance grew up. This passed uninjured through the crisis which affected the production of silk, and today there is in the district a considerable manufacture of towels, kimonos, and other goods, in most of which silk is mixed with cotton."

The demand for cotton carpet-backing has given rise to mills which spin Turkish-grown cotton, but this activity tends to develop independently, and it is increasingly producing such articles as coarse clothing and towels. The chief works of this nature are located at Manisa, Aidin and Nazilli.

On the Adana Plain important works based upon the raw cotton of the district have been erected. "Small ginning mills are numerous, Adana alone having twenty-one." At Adana there is also a baling mill operated by the Deutsch-Le-

[23] Facts in regard to manufacturing from Anatolia: Handbook, etc., No. 59, pp. 95–99.

FIGURE 8.—A gorge in the headwater reaches of one of the mountain streams that help to form the Euphrates. (Courtesy of the Near East Relief.)

vantinische Baumwollgesellschaft. Two factories, one with 10,000 spindles and 180 looms, the other with 5,000 spindles and 50 looms, likewise are located at Adana. At Tarsus two cotton-spinning mills use 20,000 and 6,000 spindles, respectively.

Pottery and glazed tiles are made at Kutahia, in the district around Chanak on the Dardanelles, at Adalia and Mersina. Soap manufacture at Aivali and Edremid is based on the extensive olive groves of that district. Machinery and machine parts are made at Smyrna, and there wooden boxes for figs and raisins are constructed, the wood used being imported. Boats of old-fashioned design but fine workmanship are built along the Black Sea coast; the wood comes from the forests of the seaward mountain slopes.

TRADE

The Region of Mediterranean Agriculture is the only region which fronts on the sea. All the overseas trade of Asia Minor is sent through it, and all transshipment between land and water takes place within it, therefore commercial and allied activities are developed on a rather large scale.

Certain aspects of this commerce can be treated with confidence. There is no reason to believe that the main routes of trade will change, converging from valleys and mountain passes onto the coast cities of the region, and from these cities concentrating further, by sea-routes, on the nearest entrepôts—Constantinople, Smyrna and Alexandretta primarily.

Anatolia as a whole will probably again become self-sufficient in native cereals when her man-power has been reconstituted and methods of tillage and of distribution improved, for she has the cereal lands and the cereal climates. In all probability a surplus for export will be produced. High-grade barley is normally shipped to Europe for malting.

The land can be made self-sufficient in rice only by expensive irrigation works; it is probable that this grain will be imported as in the past from areas which produce it cheaply and in quantities sufficient for export, in particular from Burma and Siam.

Coffee and sugar, foodstuffs which are used in great quantities in the country, but which cannot be grown there [24] will continue to be imported.

Manufactured goods of the finer grades will be brought into the country as in the past, but little by little the importation of cheaper grades should fall off as domestic industry gains headway.

[24] Sugar cane is grown in the plain of Adana, but sugar is not made from it. The cane is chewed by the people of the plain. Without irrigation and an abundant and cheap labor supply, cane-growing can scarcely reach much significance.

The exports may be expected to increase under settled and more intensive economic development.

THE REGION OF PASTORAL NOMADISM

The Region of Pastoral Nomadism embraces more territory than any other region of Anatolia. The density of its population and the value of its products are much less than in the Region of Mediterranean Agriculture just considered, but much more important than in the combined Regions of Forest Exploitation.

From the economic standpoint the Anatolian steppe has small significance compared to the lands which front on the sea. The steppe nevertheless dominates the life of all Asia Minor by the quality of the men it produces. From the plateau, for centuries, has been derived the energy, the character and the military skill which has kept the richer lands in economic and political subjection. Constant exposure in the open, and tribal organization, produce men physically hard, self-reliant, and disciplined for warfare. " . . . by the consent of all who have observed him, the Turk is the best individual soldier in the world"[25]—an opinion which is backed up by the British "Tommy," a fighting man of impartial judgment and wide experience.[26] The recent removal of the Turkish capital from Constantinople to Angora may be looked upon from one point of view as indicating a decision on the part of the leaders of the country to this effect: that the lands which produce men are of more value than the lands which produce wealth.

PASTORAL NOMADISM

The precise importance of the livestock industry of any given area in Asia Minor cannot be determined. Animal statistics are quoted for the whole of Turkey, and since animal production is not confined to any one region but is carried on in them all, and reaches major significance in two, inference or deduction is of little avail in apportioning the herds and flocks to the different regions. Wide differences exist, in fact, as between various estimates of the total livestock in Anatolia; but stock-raising is the chief industry of the plateau of Asia Minor, and a few rough generalities in regard to distribution and geographical relationships may be presented.

The main reason for the predominance of pastoral activities in the region is the relatively small amount of rainfall throughout the year (Fig. 2), which prohibits rich cultivation except in special cases which will be considered later. The annual rainfall of most of the region is under fourteen inches a year, most in winter.

The summer is a time of dryness interrupted only by rare convectional showers. The moisture comes from the seas which border Anatolia on three sides. Although the winds blow inward to the area of low atmospheric pressure which prevails over the interior in summer, the land surface is so hot that the winds increase their moisture-holding capacity and little or no precipitation results except on mountain slopes. In winter, dry winds descend onto the interior and thence flow out towards the coasts. The interior like the coast gets its rain from winter "lows."

Another reason of considerable importance which accounts for the prevalence of stock-raising in comparison with the more lucrative agriculture, is the fact that the soil of large areas in the region is unsuited for anything but the growth of grasses and bushes, either because of its shallow depth, its high alkaline content, or its coarse texture.

The processes of weathering work slowly because the rainy reason and the hot season do not coincide, and such soil as is formed is rapidly removed by the run-off from sudden, short, torrential rainstorms. The water that does pene-

[25] M. Townsend: "Asia and Europe," 3d Edition, New York, 1905, p. 7.

[26] The "Tommy" usually ranks the Serbian with the Turk as a fighter.

FIGURE 9.—Hauling grain to the threshing floor in one of the upper valleys of Anatolia. (Courtesy of the Near East Relief.)

trate into the soil and dissolve some of the mineral matter is evaporated in the hot sun, and a crust of alkali is formed in many places. The alkali on or near the surface is most pronounced in the drier southeast portion of the region where lies Tuz Cheullu. This lake, only a few feet deep, covering about 4,000 square miles, has a salt content of 32 per cent. The extent to which evaporation goes on in the region may be judged by the fact that the difference between the winter and summer levels of the lake, due mostly to evaporation—the lake is not drained—amounts to two and a half feet, and between the two levels the people of the district obtain salt in the summer time which they send to other parts of the region.

In many areas there is scarcely any soil at all. The surface is paved with gravel and small stones.

As in the Region of Mediterranean Agriculture, stock-raising is based, to some extent at least, on the existence of high and low pastures, the high pastures being utilized in summer after the snows have melted, the low pastures in winter during the moister season. The interior of Asia Minor is a plateau only in the sense that all the land is elevated. The flat surface is broken at numerous points by high mountains. To the traveler it appears as a plain and mountain country. Winter pastures on mountain slopes are nowhere far distant from the comparatively level, lower-lying tracts. The vegetation is so sparse, however, that the animals are almost constantly on the move, cropping one grazing ground and moving on to the next.

Without doubt sheep constitute the most numerous stock animals of the region. They yield wool, mutton and milk. They form the chief source of meat for the whole country, since cattle require relatively rich pasturage, of which there is little, and the use of hog products are forbidden by the Mohammedan religion. Sheep are consumed in large quantities in the region itself, and many are driven slowly to the markets of the west such as Constantinople and Smyrna, pasturing on the way. The same is true of Armenia and Kurdistan to the east, from which animals are driven the whole length of the peninsula. Thus at all times everywhere in the region large flocks not native are in transit. The passage of sheep from Armenia across the region to Constantinople sometimes occupies a whole year.

The wool is made into clothing for local use. When manufactured into rugs, it is shipped out of the region to the coast cities, where it gets into international trade. One of the important rug markets is Isparta in the southwest.

The milk of the ewes is consumed locally after it is converted into one of the few dairy products of the steppe, but a substance so characteristic of all Anatolia and of the steppe in particular that it merits detailed description. "There are several sorts of Anatolian yoghourt—from the milk of ewes, buffaloes, goats, and cows. . . . Yoghourt-making and vending is a distinct business calling in Turkish towns; but in country districts every peasant woman has the skill. A yoghourt man goes through the whole process in his little shop. He heats the milk carefully, brings it to a gentle simmer, and then pours it into bowls of various sizes according to the demand in his trade. Next follows the critical operation. As the milk cools he must hit the proper temperature at which to impregnate it. He makes use of a thermometer—his little finger to wit—and this he inserts at the edge of each bowl, carefully pushing back the cream, for he must study the look of his goods. The right temperature reached, he introduces a small spoonful of old yoghourt, again at the edge, taking care not to disturb the cream, and gives it a deft stir or two. In completion, he drops a few black seeds in the middle of the cream as charm against the Evil Eye. When the basins are cold they contain yoghourt ready for use; a substance without fluid, firmer than junket, and which, for twelve hours, has scarcely any acidity. Of this sort is Anatolian yoghourt, a food of nomad origin, which a man is content to eat twice a day for a year and ask no change. Drink raw milk of the country and you die with an approach to certainty; but experience shows you may eat yoghourt anywhere and fear no ill." [27]

[27] W. J. Childs: *op. cit.*, pp. 113, 114.

FIGURE 10.—The creak of the primitive pumps is stopped only at brief intervals throughout the dry season, on most of the irrigated hill farms of the interior districts. (Courtesy of the Near East Relief.)

Goats are almost as numerous in the region as sheep and they are utilized similarly—for their milk, their hair, known to commerce as mohair, and their meat. The animal is well distributed through the region, but the district to the northwest of Angora is known over the world for the quality of the wool—a long, white, silky fleece—which the goats in that section grow. The mohair which is baled and sent to Constantinople for export each year amounts to more than three million pounds.

The goat can be raised in areas of rather sparse natural vegetation. But the effect of the animal on the vegetation it chooses to crop appears to be no less striking than the effect of the vegetation on the choice of the animal to crop it. "No one can see without surprise and curiosity the oak and beech scrub which covers so much of the country. It seems to consist of some unfamiliar dwarf species. The bushes all grow to about the same height, and there they stop, though to the eye the oak and beech of the forest. It is a puzzle until you see the cause; but even then there is difficulty at first in realizing that the cause is so universal and unfailing in operation. Pass through these districts and you find

goats among the scrub in thousands . . . and often, as you go, a sapient bearded head rises above the bushes, and the animal, standing on its hind legs, nibbles off the topmost young shoots in demonstration of how the universal goat controls the scrub." [28]

The water buffalo is raised in the lower lying, swampy situations in the regions which are too unhealthful for other animals and where forage is abundant. From such places they are exported to all parts of Anatolia for use as draught animals.

Camels and horses are reared, particularly in the southeast of the region. The camel is the beast of burden of Anatolia. Wherever the railroad does not penetrate—and it penetrates into but few districts as yet—the camel train bears the commerce of the country.

FIGURE 11.—Native carts at Afium Karahissar far inland along the mideastern edge of the Region of Mediterranean Agriculture. (Courtesy of the Near East Relief.)

AGRICULTURE

Agriculture in the Region of Pastoral Nomadism is confined to well-watered areas located either close to "rain islands," such as the Kaisariya district, which is based upon the rainfall resulting from its proximity to Erdjias Dagh, or else near streams which can be used for irrigation, as at Amasia in the northeast.

Grains can be grown in most of the region without irrigation. All other crops require watering. The winter temperatures are too severe to permit the cultivation of the olive and the fig, and apple, pear, and other fruits resistant to cold, but with high water requirements, come in. The grape is important in this region as it is on the coasts.

Irrigation is precarious, however, in a land of nomads, of unsettled political and economic conditions. It is best developed about towns which are sheltered from external troubles by the strategic strength of their natural surroundings; Amasia, situated in a gorge, is a good example. About towns in exposed situations such as Sivas, on the open plain, a city which under more orderly conditions was the center of an exceedingly rich agricultural area, irrigation is little developed.

The only cultivated product of the region that gets into international trade in an important way is opium. This plant

[28] *Ibid.*, pp. 27, 28.

is ten times more profitable to raise than wheat and it is distinctly a money crop since only the seed is used in the country; the drug is entirely exported. The seed is planted before the autumn frosts and harvested the following July. Too much moisture is more likely to be injurious than too little, so the slight rainfall in the region is no drawback.

The yield per acre averages about two and a half pounds of opium and two hundred pounds of seed, the latter having about two-thirds the value of the opium. Opium is a product of high value and small bulk; it stands the costs of transportation well.

The plant is grown in the Region of Mediterranean Agriculture as well as in the region under discussion, but the best and the most opium appears to come from the latter, probably because of the greater dryness, year in, year out, during the critical harvest time.

Anatolia ranks with China and India as one of the world's great opium producers. The Anatolian product is superior to the others in quality and for this reason is largely exported to the west, particularly to the United States, for manufacture into medicines.

MINING

Mining is not important in the region, partly because the deposits are comparatively little known to the western world, as a consequence of their remote interior position, partly because the facilities for transportation to the chief consuming areas and markets on the coast are inadequate, and partly because no adequate fuel supplies exist, or are known to exist, close to the mines. Several mines closed down after the contiguous forest had been cut off to furnish wood for fuel and for timbering the shafts, and the logs had to be brought from such distances that the cost of transporting them finally became too great.

Mercury and sulphur are mined in the Sandjak of Konia. Exploitation of rock salt by the government has been undertaken in a number of places in the Vilayets of Angora and Konia, but most of the salt used in Anatolia is derived from crustal deposits which lie on the surface of the ground and are easily worked. The government has also exploited fuller's earth on a large scale at Mikalijik in the Vilayet of Angora.

FOREST RESOURCES

Exploitation of the few forests of the region, which are located on the upper mountain slopes, is insignificant. The timber cut suffices to supply the few needs of the people of the area. The most important use of the wood is for conversion into charcoal for use in the homes of the plateau people. Smoke from the fires kindled by charcoal-burners, many of whose ancestors were engaged in the same business in ancient times, may be seen issuing from the wooded slopes of all the mountain ranges of the region.

THE REGIONS OF FOREST EXPLOITATION

Three Regions of Forest Exploitation can be marked out in Anatolia, noncontiguous areas which are essentially similar. Their total economic significance is relatively slight and large portions of them are actually little known.

THE NORTHERN REGION OF FOREST EXPLOITATION

The mountains which crowd the narrow agricultural strip of the Black Sea coast rise abruptly to an elevation well above four thousand feet. The trees consist of oak, beech, fir, chestnut, elm, lime and black pine. Anatolia is the richest country in the world in the variety of oak-trees it possesses. On the northern and western mountains fifty-two important species grow—all France has only twelve—of which twenty-six are not found elsewhere.[29] The sea winds toward the interior are forced to rise over the mountain rim and precipitate a great

[29] É. Reclus: "Nouvelle Géographie Universelle," Paris, 1884, Vol. IX, p. 528, cited after Tchihatcheff.

FIGURE 12.—The beautiful environs of the city of Batum, one of the most important ports of the northern coast of Asia Minor. (Courtesy of the Near East Relief.)

deal of moisture on the slopes. The forest is most dense in the west of the region, a section known to Anatolia by the Turkish equivalent of the "Sea of Trees." Wood for shipbuilding is cut in all the region, but particularly in the west. Lumbering for construction, for firewood, and for conversion into charcoal goes forward on all the sea and valley slopes.

In the few situations where the river valleys widen out to form stretches of arable land, small agricultural towns are located. Such a place is Kastamuni which lies in rain-shadow and is therefore based upon irrigation agriculture. The summer heat in the town is almost unendurable because of its situation in a topographic "pocket," and of the many towns of Anatolia known for fever, Kastamuni is one of the most prominent. Stock-rearing is hazardous because of the number of brown bears and other wild animals abundant in the forest.

THE NORTHWESTERN REGION OF FOREST EXPLOITATION

The main question in the consideration of this region is how this area has escaped the deforestation, settlement and development that the surrounding Region of Mediterranean Agriculture has undergone. The answer is that it is extremely difficult of exploitation as it is mostly unsuited for agriculture, because of the rugged relief. The region is made up of maturely dissected mountain country which at several points rises above five thousand feet. Only a small part of the region is exploited in any way at all. On lower slopes in the west, wood, chiefly pine, is cut and shipped down the valleys, and acorns from the valonia oak are gathered for export. A few cattle are pastured along the valleys. The eastern part of the region is an almost uninhabited, unutilized, forest wilderness. A small amount of wood is cut, but the difficulties of transport are so great that only the smaller branches can be taken out. Deer and bears live in the forest. The latter are captured and sold to be trained and used as dancing bears. A little grazing and agriculture are carried on in the valleys, but transport is so difficult that only the valuable opium can stand the cost of shipment.

THE SOUTHERN REGION OF FOREST EXPLOITATION

The southern region is economically the most important of the three forest regions, not because the forest cover is exceptionally thick but mainly because

it is bordered by two large plains with numbers of people who need wood. As might be expected, the forests on the mountains which shut in the Adana Plain and which constitute the largest lowland area and wood-market adjacent to the woodland have been most actively worked; yet great tracts of this timberland, nevertheless, remain unexploited.

The trees in the extreme west of the region are utilized chiefly for shipbuilding along the nearby coast, and they have been so used for centuries.

The lower slopes of the mountains, where the tree cover is relatively sparse, carry cattle in the summer. To these slopes in the hot season come many people to escape the terrific heat of the coastal plains.

SUMMARY

If the forests were vigorously worked, Anatolia could satisfy her own needs and export a surplus to such timber-poor countries as Egypt. Even should modern methods be applied, however, it is probable that the inaccessibility of the timberlands, by reason of the rough character of the country on which they grow, will retard exploitation. It is likely that Anatolian timber production will always lag behind actual requirements.

GEOGRAPHIC FACTORS IN THE TRINIDAD COCONUT INDUSTRY

Preston E. James

Assistant Professor of Geography, University of Michigan

COCONUTS may be grown under a wide variety of conditions; but the conditions under which a thriving coconut industry may develop are rather narrowly limited. Broadly speaking, the coconut palm is limited to a Tropical Rainy climate. Within the areas on the earth's surface where climatic conditions are favorable, the distribution of ideal sites for coconut cultivation is further influenced by soil and drainage. Apparently soil texture is of greater importance than soil composition, for coconut palms are found growing on many different kinds of soil, but thriving only where the soil is friable.[1] If the soil is rich as well as friable, the best conditions are found. In addition to this, the drainage must be rapid and complete. The ground water table should be close to the surface, but never stagnant.

If coconuts were produced only on the best suited lands by intensive cultivation, the industry might be called adjusted to the natural conditions. However, in most of the countries of the American tropics, due to the absence of sufficient economic pressure, cultivation is still extensive and only the beginnings of adjustment can be discerned. In this respect, the island of Trinidad, a Crown colony of Great Britain, is typical of many similar areas. Located 10° north of the equator it has a tropical rainy climate, and in a few limited places can boast of ideal soil and drainage conditions. The extent to which the coconut industry is localized in these areas, and the problems which must be faced in coconut production on the island are representative of conditions in many other parts of the tropical world.

[1] A. Fauchere: "The Soil in Coconut Cultivation." Bull. of Misc. Inform. Trinidad Botanical Dept. Port of Spain, 1908. pp. 21–24.

THE LOCALIZATION OF THE COCONUT INDUSTRY IN TRINIDAD

In 1836 coconuts were not included in tabulations of either crop acreages or production in Trinidad.[2] At that time, however, coconuts were growing on the island, especially along the sandy eastern coast (Fig. 1) where nuts drifting from the neighboring South American continent had lodged and had grown without any form of cultivation. The many uses to which a coconut palm may be put, resulted in a local native industry at that time. The coconut milk was fermented to make an alcoholic drink; the fibre was prepared and used for stuffing mattresses and saddles and for making a coarse rope. The crushed nut yielded an oil which the East Indians especially used for cooking in place of the tabooed animal fats.

Early Plantations

By 1880 the beginning of a coconut industry had been made at the Cocal (Fig. 2) which occupies the sand bar along the sea margin of the Nariva Swamp. Here coconut palms of a certain species had grown, as a result, says Kingsley,[3] of the wreck nearby of a ship loaded with coconuts. In the Cocal, the nuts were picked and the products manufactured, but no form of cultivation, even planting, was practised. This natural growth was the result of an extremely favorable combination of conditions. The waters of the Nariva Swamp

[2] The Trinidad Almanac and Public Register, for the Year of Our Lord 1837. Port of Spain. 1838.

[3] C. Kingsley: At Last; A Christmas in the West Indies. London, 1885. p. 327.

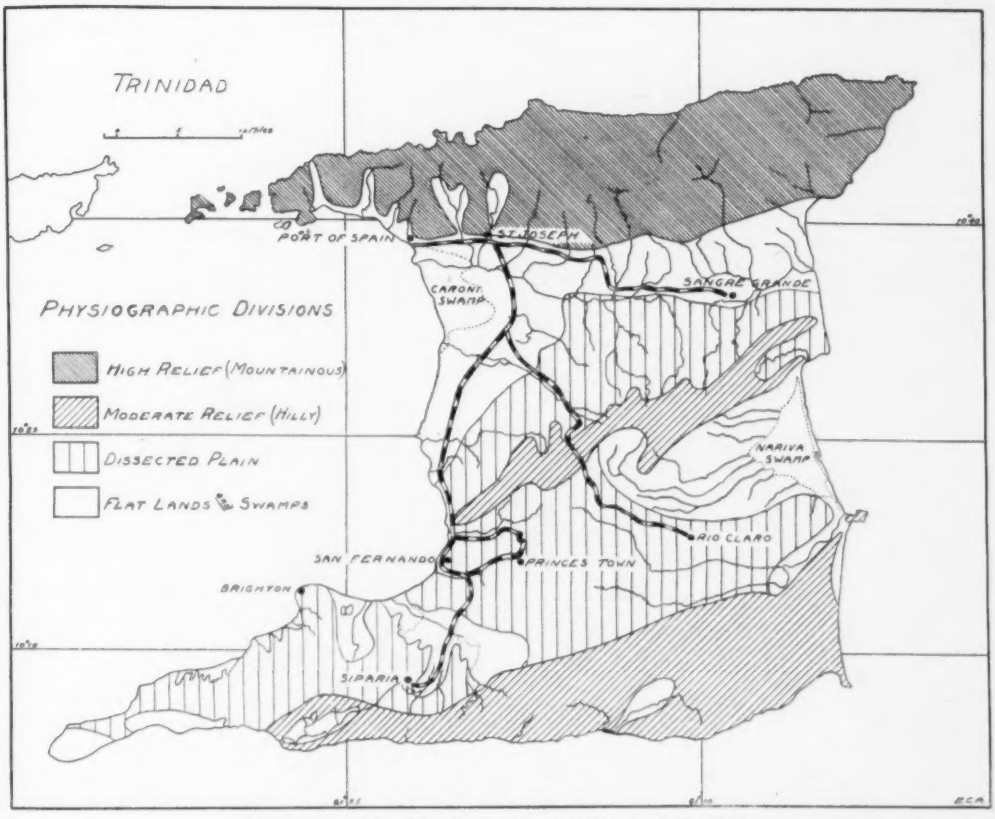

FIGURE 1.—The Physiographic Divisions of Trinidad.

(Fig. 1) seep through the fine sand of the bar with the greatest regularity, and being highly charged with organic material, they have imparted to the soil a rich black color, especially on the inner margin of the bar. Furthermore, the heavy rainfall in the area draining into Nariva Swamp (Fig. 3) insures a constant and rapid movement of the water seeping through the bar, even after a protracted drought. In fact floods, when the swamp waters break across the sand bar, are more feared at the Cocal than droughts.

THE NARIVA-MAYARO DISTRICT

Because of these favorable natural conditions, the localization of the coconut industry along the eastern coast of the county of Nariva (Nariva Beach) has continued to the present time. Furthermore, the fringe of coconut palms lining the shore (Fig. 4) has extended southward in the county of Mayaro almost to the southern coast. The southward extension is stopped at the position shown in Figure 2 by the disappearance of the sandy coastal flats at the eastern end of the Southern Range of hills (Fig. 1). Probably conditions are not quite as favorable south of Radix Point (just south of Nariva Swamp, Fig. 1), although the plantations in this vicinity yield well with cultivation. This area is called the Nariva-Mayaro District.

THE NORTH COAST DISTRICT

In addition to the district just described, there are two other areas in Trinidad where the coconut industry is showing a tendency to localize in response to favorable natural conditions. One of these is the North Coast District (Fig. 2), which includes a number of

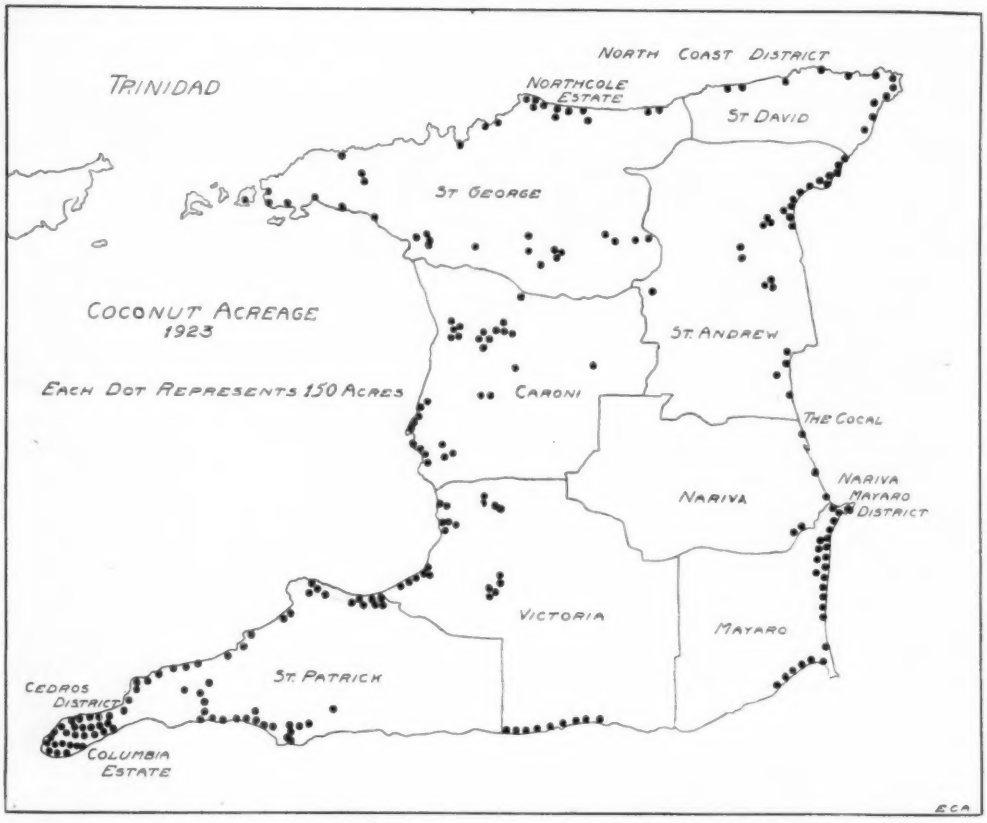

FIGURE 2.—The Distribution of Coconut Acreage in Trinidad in 1923.

isolated patches along the mountainous northern shore (Fig. 1), and a small portion of the northeastern coast just south of Galera Point (northeast corner of the island). Throughout this district the land, descending abruptly from the ridges of the Northern Range, is marked by a well developed marine terrace between 100 and 200 yards in width. In the eastern part this terrace is about 100 feet above sea level, but it gradually descends toward the west and finally disappears entirely in the embayed section west of Point Fillette (the prominent point a little more than midway along the northern coast). The soil on this marine terrace is a loose sand mixed with sufficient humus to give it a dark color. The water from the rainy northern slopes of the mountains (Fig. 3) drains off with ease and regularity through the sandy soil, thus offering excellent conditions for coconut cultivation. West of Point Fillette, the coast is much embayed (Fig. 1), and the coconut palms line the inner edge of the sandy beaches at the head of each bay.

THE CEDROS DISTRICT

The other major coconut area in Trinidad is called the Cedros District and occupies the end of the southwestern Peninsula (Fig. 2). Here the Dissected Plain (Fig. 1), usually characterized by physiographic youth and a relief of somewhat less than 100 feet, becomes lower and lower as it approaches the western end of the peninsula. The edge of the Dissected Plain represents the former end of the land, and beyond it the silt-laden waters of the Orinoco have added a series of sand spits, each inclosing behind it a marshy lagoon. The soil in the Flat Lands (Fig. 1) is a black

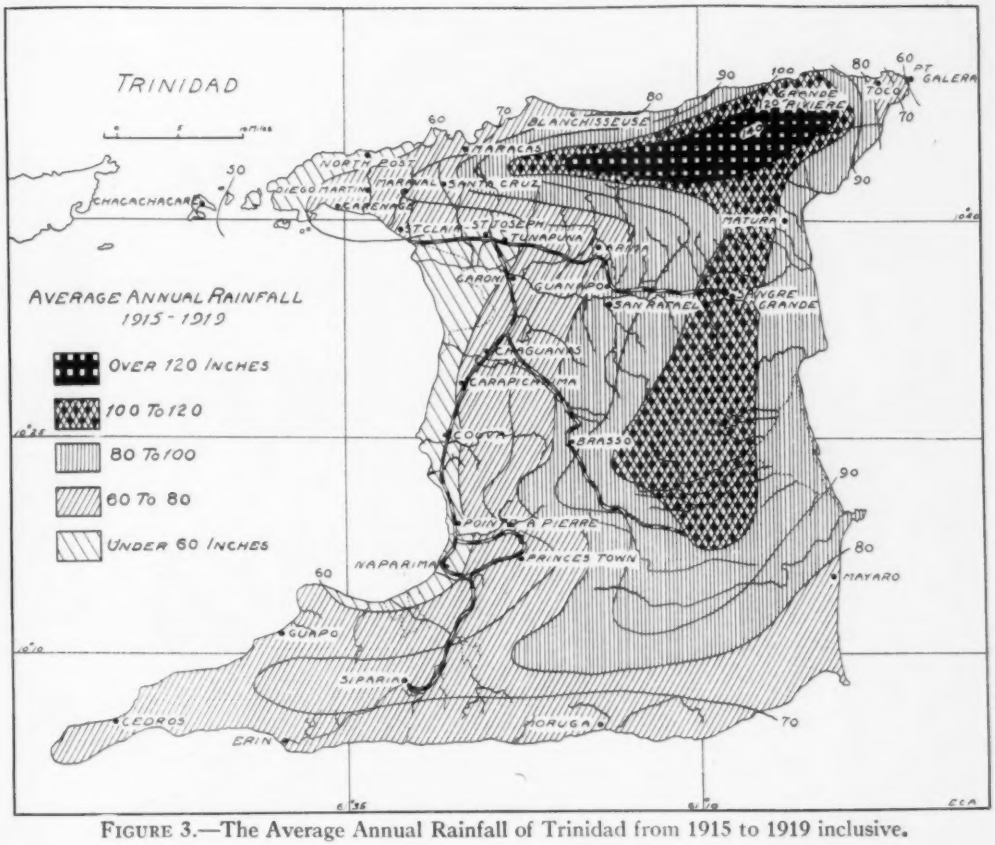

FIGURE 3.—The Average Annual Rainfall of Trinidad from 1915 to 1919 inclusive.

sandy loam. Although drainage conditions are perhaps not as good here as in the other two districts, the location across the calm waters of the Paria Gulf from the shipping port, Port of Spain, together with a considerable investment in artificial drainage, has aided in making this district the most important producer of coconuts. The smaller amount of rainfall in this district (Fig. 3) and the smaller drainage area from which ground water may be derived makes the Cedros District more prone to suffer from droughts than either of the other two, and thus to show more clearly than either of them the influence of rainfall on crop yield and quality.

OTHER PLANTATIONS

In addition to these major coconut districts, plantations are scattered widely over the island (Fig. 2), some of them in favorable locations, but many of them in very poor situations and consequently in poor condition. At some points along the Gulf Coast the combination of ground water and drainage is favorable, and here coconuts are doing well. However, in so far as these other plantations are located on poor coconut soils, or on inadequately drained land, they represent a condition of maladjustment to the geographic conditions.

THE RELATION OF COCONUTS TO OTHER CROPS

An interpretation of the present coconut distribution would be incomplete without some mention of the relation of coconuts to other crops which, in Trinidad, compete for the use of the land. These are primarily cacao and sugar cane. Cacao has been the foremost commercial crop of the island since early

colonial times, and still claims the largest acreage of any one crop. Both coconuts and cacao are crops which require a large investment with several years of growth and with no returns before they begin to bear fruit. Thus, although the market for these products is extremely variable, the acreage cannot respond quickly to price changes. The acreage responds rather to the longer trends and deep seated changes, and is more permanent in its response than is the case, for example, with middle latitude cereals or even sugar cane. The present large acreage of cacao in Trinidad is a result of a long continued prosperity in the cacao market, in which the production of cacao yielded rich returns with a minimum of cultivation. In the year 1920, the cacao crop brought the abnormally high price of $23.90 per bag of 112 lbs.[4] Since 1920 the prices have fallen radically, so that the cacao growers in Trinidad have been faced with ruin. This was the result in part of greatly increased production of low grade cacao from West Africa, and in part of the greatly decreased consumption of chocolate in Central Europe. During this time the market price for coconuts and coconut products has remained satisfactory and in the last year has taken a rapid jump upward. For these reasons many cacao planters in Trinidad have begun to cut down their cacao trees and plant in place of them coconuts. Unfortunately these young coconut plantations have more often than not been made on soil unsuited to coconut cultivation—on sticky clay soils where drainage is imperfect. Cacao on the other hand, cannot be grown properly in exposed windy places (Fig. 5), since the wind dries up the fruit pods, while coconuts are not bothered by the wind; and, in Trinidad, the best coconut locations are all exposed to the full sweep of the Trades. Therefore cacao does not compete with coconuts on the best coconut land: the recent increases in coconut acreage at the expense of cacao having come on relatively low grade coconut land. There are, of course, some exceptions to this general statement.

FIGURE 4.—Coconut palms fringe much of the eastern coast of Nariva County and far southward.

[4] Correspondence with the Bureau of Foreign and Domestic Commerce, Washington, D. C.

FIGURE 5.—A cacao estate in an interior valley. Cacao cannot be grown in exposed windy places, since the wind dries up the fruit pods, while coconuts are not bothered by the wind.

Sugar cane requires above all things a rainfall of about 60 inches or over, and also periods of sunshine to increase the sugar content of the cane. Thus in Trinidad, where the rainfall is adequate for sugar in almost all parts of the island (Fig. 3), the cultivation of the cane is definitely localized along the Gulf shore in western Trinidad where the highest percentage of hours of sunshine are to be had (Fig. 6). Therefore the sugar crop comes into direct competition with only one of the major coconut districts, namely Cedros District. In fact sugar was grown over most of the Cedros District as late as 1890, but since that date has gradually disappeared from that part of the island. The more fundamental causes of this change are probably: (1) the expense and scarcity of labor in the Cedros District as compared with the sugar districts closer to Port of Spain; (2) the greater cost of transportation for sugar cane from Cedros as compared with the costs from areas served by the early railroad which ran from Port of Spain to San Fernando and later to Siparia; and (3) the prevalence of malaria at Cedros which resulted from the undrained swampy tracts along the coast. Within the sugar district itself, which extends from Port of Spain along the Gulf coast to the Oropuche Swamp just south of San Fernando (Fig. 1), a number of coconut plantations may be seen (Fig. 2), many of them on land owned by the sugar estates, but not planted to sugar for various reasons. Many of these plantings are on lands better suited to sugar than to coconuts, but which are held in coconuts owing to the scarcity of labor in Trinidad as a whole.

A STUDY OF A REPRESENTATIVE COCONUT ESTATE—COLUMBIA ESTATE, CEDROS[5]

The Columbia Estate, in the Cedros District, may be taken as representative of the better managed estates of Trinidad. This estate includes about 1,340 acres of land. It is located near the end of the southwestern peninsula,

[5] Personal observation at Columbia Estate and conference with its owner and manager, Mr. A. J. Anderson, Lochmaben House, Columbia Estate, Cedros, Trinidad B. W. I.

bordering the Paria Gulf on the north and extending nearly but not quite to the southern shore (Fig. 2).

GEOGRAPHIC CONDITIONS OF PRODUCTION

With the exception of the northern and eastern edge, the estate lies entirely within the Flat Lands and Swamps previously described. The northern and eastern edge of the estate is on the higher land, about 50 feet above the swamps.

FIGURE 6.—Plowing sugar cane land; the zebu cattle are draft animals. The cultivation of sugar cane is definitely localized along the Gulf shore in western Trinidad where the hours of sunshine are longest.

Thus, on this estate, the problem of drainage is one of the most important problems demanding solution. The soil, outside of the marshy lagoons, is a dark colored sandy loam, easily permeable by ground water. The drainage from the Dissected Plain gives a fairly constant supply of water, which, when proper drainage canals are dug to lower the water level in the marshy lagoons, moves off rapidly toward the sea, thus giving excellent conditions for the coconut palm.

No rainfall records have been kept at Columbia Estate itself, but Perseverence Estate,[6] its neighbor on the northeast, has kept accurate records since 1914. From 1914 to 1924 inclusive, the average annual rainfall was 57.85 inches. During this period the lowest annual rainfall was 49.06 inches in 1915, and the highest was 69.69 inches in 1917. The rainfall is distributed during the year in a marked Dry Season extending from January to May, in which approximately 31 per cent of the days have some rain; and a marked Rainy Season from June to December in which 59 per cent[7] of the days are rainy. On the average 20.1 inches fall during the drier half of the year, January to June; and 36.2 inches fall from July to December. The rain comes usually in the form of convectional showers, characteristic of this type of climate.

Among these critical geographic conditions of coconut production should be mentioned the diseases which attack the palms. Several diseases are prevalent at Columbia Estate, as in fact in all parts of the island, for none of the coconut districts are free from them. Chief among these are Bud Rot and Red Ring. The latter especially is a serious menace to the industry as a whole, although kept fairly well under control at Columbia Estate. Healthy trees may contract Red Ring and in the space of a week be entirely dead, the disease striking here and there through the plantation. As is

[6] Figures furnished by Mr. Romer Johnstone, Perseverence Estate, Cedros, Trinidad, B. W. I.

[7] These percentages were derived from a study of the records at Port of Spain, but are approximately the same for the Cedros District.

common among plant diseases, trees growing in the more favorable situations where soil is rich or ground water supply plentiful and drainage rapid, seem more resistant to the diseases. Consequently both Bud Rot and Red Ring are commoner on the poorer lands.

The cause of the Red Ring disease is known to be a certain nematode (*Aphelenchus cocophilus*); but the method by which the nematode is carried from tree to tree is not known, so that no certain method of combating the disease has been found, and the planters stand almost powerless as their trees are attacked. Research by agents of the U. S. Department of Agriculture in the Canal Zone has suggested the possibility that the nematodes are carried from tree to tree by termites,[8] which, if true, may be a very important discovery for Trinidad planters.

PLANTATION METHODS IN RELATION TO GEOGRAPHIC CONDITIONS

As previously mentioned, Columbia Estate has an area of 1,340 acres. Of this area about 900 acres are devoted to coconuts, and the remaining 400 are taken up with estate houses, stables, copra sheds, laborers' villages, and pasture for the stock. In the latter respect, Columbia Estate is not truly representative, for most of the Trinidad estates do not carry any large amount of stock excepting those used for draughting. Columbia Estate, together with a few others, is leading the way in the introduction of zebu cattle for draught animals and for the production of fertilizer.

Up to 1890 the Columbia Estate, then divided into a number of smaller independent units, was planted to sugar cane. At that time, as explained above, coconuts began to supplant the cane throughout the Cedros District. Young trees were set out, generally under the contract system, in which a laborer contracts to bring a certain acreage of young trees to producing age, receiving in return a payment per tree and a little garden space for himself and his family. On the average, about 50 trees were planted to the acre.

CULTIVATION

Because of the lowland situation of Columbia Estate, a great deal of attention must be paid to proper and complete drainage. Trees are planted in regular rows, as is not always the case in all parts of the island, and between each row a drainage ditch is dug. A regular system of these ditches leads to a main canal which carries off the water of the marshy lagoons and maintains a constant flow of ground water throughout the estate. Regular attention is paid to the fertilization of the soil, which in the opinion of the owner is amply repaid. The coconut husks are returned to the fields, being allowed to rot on the ground between the drains. Many estates go no further than this, but at Columbia Estate manure from the cattle is spread on the fields regularly.

One of the items of cultivation to which special attention is paid on this estate is the care of tree wounds. The pickers very commonly inflict unnecessary cutlass wounds on the trunk of the tree, especially near the base. Because of the heavy rains and the humidity of the climate, these wounds become moist and begin rapidly to decay, which results in ill health to the tree and in low yields and poor quality nuts. On this estate, the decayed parts are carefully cut away, the excavations being made in such a way that water will not catch in them but will run off easily, and the holes are then tarred. Also the pickers are carefully educated to the necessity of avoiding such careless use of the cutlass, in spite of which education the wounding of trees still continues, although at a lessened rate.

PICKING, HUSKING, CROOKING

Picking is carried on throughout the year. The picker usually climbs the

[8] T. E. Snyder and J. Zetek: "Damage by Termites in the Canal Zone and Panama, and How to Prevent it." U. S. Dept. of Agric. Bull. 1232. June 27, 1924, pp. 13 and 19.

tree by means of a stout *liane* which he ties around the trunk and then under his arms. He leans his weight against this *liane* and proceeds to walk up the trunk, shifting the line upward with a rapid motion after each step. When one considers the height of the palm and the smoothness of the trunk, remarkably few casualties are reported in this work. However, when rain falls early in the morning the trunks of the trees become slippery and the pickers cannot ascend. Consequently the total number of nuts picked is much affected by the number of rainy mornings. Although the total amount of rainfall cannot be taken as a measure of this, for most of the rain comes in convectional afternoon showers, it may be confidently stated that a year with a large percentage of rainy mornings will be a year also of low yields. For this same reason more nuts are picked on the average in the Dry Season than in the Rainy Season.

The picked nuts are husked in the field in order to avoid the cost of crooking (carrying) the husks to the estate buildings and back again to the fields for mulching. The husked nuts are loaded on mules or burros, or in two-wheeled mule carts, and are carried to the bagging shed, located on the higher land on the northern edge of the estate overlooking the Paria Gulf. A network of roads makes this operation simple.

HANDLING THE PRODUCTS ON THE ESTATE

At the bagging shed the nuts are classified into three groups: selects, culls, and rejects. The selects will not pass through a ring three and three quarters inches in diameter; the culls are smaller nuts which pass through this ring; and the rejects are broken or deformed nuts. This work is generally done by the women. The culls and rejects are then sent to the copra houses, while the selects are placed in large bags. The exporting companies in Port of Spain buy the whole coconuts at this shed and themselves stand the cost of shipment to Port of Spain. The loading of the whole nuts on lighters is relatively simple at Columbia Estate because the lighters can come under the steep banks of the northern shore where the Dissected Plain borders the Paria Gulf, and lying there in the calm water, the bags can be lowered directly into them.

FIGURE 7.—Copra is dried on large platforms over which sliding roofs may be drawn to keep out rain.

The high prices paid for copra and coconut oil have caused Columbia Estate to put a large percentage of its product, even some of its select nuts, into these products. In the preparation of copra the nuts are broken and the meat is scraped out. It is then placed on large platforms over which there is a sliding roof in case of rain (Fig. 7), and is exposed to the sun for five or ten days, after which it is raked up and placed in bags, and is ready for shipment. Special oil presses are installed for the manufacture of the coconut oil.

YIELD AND QUALITY OF NUTS

Due to the smaller amount of rainfall in this part of the island, and to the small drainage area from which the ground water may come, the influence of varying amounts of rainfall from year to year may be discerned very clearly on this estate. The total yield is obviously influenced by many factors beside rainfall, however. In prosperous years more attention is paid to cultivation, which is reflected in increased yields a year or so later. The number of morning rains exerts an influence on the yield. Also the education and supervision of the pickers themselves may very appreciably influence the yield.

Nevertheless these other influences can be eliminated to a certain extent if one considers the proportion of high quality nuts to those of poorer quality. The size of nuts may be partially due to better cultivation but cannot be affected by morning rains or by carelessness in picking. The quality of the nuts shows a close relationship to the rains of the previous year. Figure 8 shows the rainfall by six-month periods as recorded at Perseverence Estate, and represents therefore alternate Dry and Rainy seasons. The upper line on Figure 8 shows the proportion of selects to culls and rejects expressed in percentage. The low rainfall of the Dry Season of 1914 resulted in a large number of small sized nuts in the second half of 1914 and the first half of 1915. The very heavy rainfall of the Rainy Season of 1917 resulted in an immediate increase in the size of nuts, and also in a continued large proportion of selects in 1918. However, the low rainfall of the latter year was felt throughout 1919 by steadily decreasing size of nuts. The size was again increased in 1920 in part by the increased rainfall of 1919, but also by more intensive cultivation practised at that time, due to the high prices realized by coconuts on the markets. The sustained high quality of the nuts in 1922 and the first part of 1923 was the result of cultivation plus accumulated rainfall of the Rainy Seasons of 1921 and 1922. The decreasing rainfall of 1923 and the first half of 1924 is shown in smaller nuts in the second half of 1923 and the first half of 1924, and predictions concerning the size of nuts for the next year may be ventured with fair certainty of success.

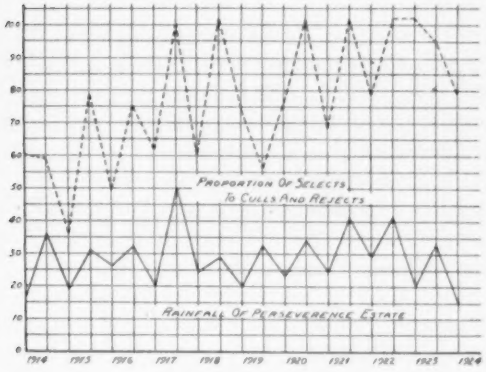

FIGURE 8.—Relation of Quality of Coconuts to Rainfall on Perseverence Estate, Trinidad, from 1914 to 1924 inclusive.

This relationship may be worked out mathematically. When the correlation is made between rainfall for any one six-month period and the size of nuts for a six-month period one year later, a coefficient of .733 is found, with a probable error of ±.072. This is a very high correlation and indicates beyond a doubt the importance of rainfall in determining the quality of the crop one year later. The correlation between rainfall and the size of nuts for the same six-month periods gives a coefficient of .508 with a probable error of ±.109; high enough to suggest an important influence on the immediate crop, although not as great as on the succeeding crop.

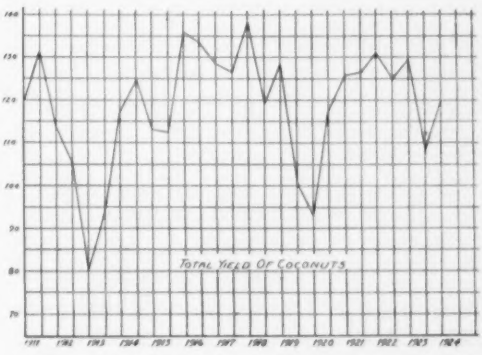

FIGURE 9.—The total yield of coconuts by six-month periods at Columbia Estate, 1911–1924 inclusive.

As far as total yields are concerned, the many non-climatic factors which influence yield cloak the relationship with rainfall. The total yields for the period 1911 to 1924 by six-month periods are shown on Figure 9. The high yield of the first half of 1918 came after the heavy rains of 1917, and the low yield of the first half of 1920 followed the period of deficient rainfall in 1918 and 1919. A

mathematical correlation for the whole period is, however, very low.

PLANTATION METHODS

In many cases the plantation methods are varied significantly from year to year in response to such non-geographic conditions as market price. The tremendous fluctuations which characterize market prices of almost all tropical products handicap the development of sound agriculture by creating the air of speculation rather than investment. At Columbia Estate the amount of work done in cultivation is varied along with the income. The distribution of cost per 1,000 nuts is shown in table 1 for the first six months of 1922. Relatively little was spent on "old cultivation" in that year, owing to the low market price. On the other hand, when large receipts

COST PER 1,000 NUTS AT COLUMBIA ESTATE
January to June, 1922

Staff, supervision, etc.	$2.10½
Medical aid	.08½
Stock, feed, etc.	3.19
Up-keep, carts, roads, etc.	.60¼
Up-keep, buildings	1.45
Old Cultivation	1.88
Young Cultivation	.....
Picking	.66¼
Crooking	.77¼
Husking	.56¼
Selecting, bagging, and loading on lighters	.54¾
Drying copra	.37
Insurance and taxes	.99¾
Total Cost	13.22½
Receipts	15.18
Net Receipt	1.95½

were the rule, a larger sum was spent on cultivation. On many of the other estates in Trinidad the large incomes of prosperous years were squandered on trips to Europe, and such estates found great difficulty in weathering the condition of universal economic instability which followed the war.

The coconut industry is fortunate in having three distinct products to place on the market. Columbia Estate can send either whole nuts, or copra, or oil, according to the market prices. This is unquestionably an important stabilizer, especially as expensive machinery is needed only in the case of the oil. Copra can be produced inexpensively at Columbia Estate by the sun-drying process.

LIVING CONDITIONS

At Columbia Estate the laborers rent small portions of the estate lands, build their own homes and raise their own food crops. The lands set aside for this are located on the higher northern and eastern rim of the estate on the edge of the Dissected Plain, where higher and drier ground makes conditions a little more sanitary. The laborers live together in villages composed of wooden shacks roofed with corrugated iron, and built close together on either side of the road. The homes are small and the families large, which results in a condition of crowding which would be intolerable in some parts of the world. In this respect Columbia Estate is similar to all parts of Trinidad, and is vastly superior when compared with conditions in India, the homeland of most of the laborers. There is no attempt to enforce rules of sanitation, such as are found in the Canal Zone, where laborers' cottages are built on piles, screened, whitewashed, and protected from vermin. Such expensive sanitary measures can only be undertaken where the cost can be supported by companies with large capital, or by a rich nation where expense is not an important consideration. The oil workers in Trinidad are housed under far better conditions, but the expense of such improvements would be prohibitive to the coconut planters.

The owner's home is situated on the higher eastern margin of the estate, on a hill which overlooks a considerable area. In construction it resembles the estate homes elsewhere on the island, being built on tall concrete piles, with large airy rooms, broad shaded verandahs, and corrugated iron roof painted red and sharply peaked to shed the heavy rains. The furniture is of excellent quality, and such luxuries as a Victrola are to be seen; but on the other hand the house is not supplied with plumbing, and

there is no attempt at screening. In the evening the mosquitoes are thick on the dark verandah, and moths flutter about the gasolene lamps with which the living and dining rooms are lighted. The owner explains carefully that he prefers to have mosquitoes than to shut out the air by screening. This is a condition common in the coconut districts, and one which is made worse by the fact that the swampy land surface which so commonly prevails close to coconut estates furnishes abundant breeding grounds for malarial mosquitoes. In the early days of the colony, Cedros was considered one of the most unhealthy parts of the island.[9] At the present time almost every white person in the district suffers periodically from malaria, with a resulting loss of vitality. Relief from this condition, as mentioned above, would involve heavy expense which does not seem justified at the present time.

The food supply shows an interesting relationship to the frontier character of this district. The supply of meat is plentiful and relatively cheap, as it was formerly in the United States. As a result, we find a great deal of meat consumed with much waste. Three meat courses at a meal is only a reflection of abundance. Most of the meat supply at Columbia Estate is bought from merchants in Port of Spain, probably derived in larger part from the Llanos of Venezuela, since very little of Trinidad is devoted to cattle raising. Vegetables and fruits can be raised locally. There are many varieties of tropical fruits such as the Avocado, the Mango, or the Breadfruit and others, which could be used even more than they are. It is sometimes surprising to see canned peaches served, while just outside of the window is a tree loaded with delicious Avocado pears. Often, too, tinned milk from Denmark or Switzerland is used, although with a little care an excellent supply of good milk could be obtained from the Zebu cows on the estate.

[9] Warden's Reports for 1896. Gov't Printing Office, Port of Spain, Trinidad, 1897, p. 29.

The white managers and owners in the coconut districts live much as feudal lords, with their subjects, the colored laborers, expressing loyalty or dislike according to the manager's method of handling his labor problem. Social contacts excepting with neighboring estate owners is limited, so that most owners, at least in times of prosperity, prefer to live in Port of Spain and leave the daily management of the estate to a subordinate. Times of financial stress, however, force the owners into the country with resulting better management. A fairly long vacation spent in some more progressive part of the world is greatly needed; not so much to recover from the supposed effects of exposure to a tropical climate, as to receive the stimulation which comes from close contact with the currents of thought in the active world. Permanent contact with a few equals and many inferiors in an isolated locality must exert a deadening influence quite aside from the effects of climate.

RELATION OF COLUMBIA ESTATE TO OTHER ESTATES IN THE CEDROS DISTRICT

The conditions of production are not equally favorable in all parts of the coconut area at Cedros. As is probably common under such circumstances, the proximity of an area of unusually favorable conditions for the production of a crop, induces people who arrive too late to get pieces of the best land, to plant the crop on poorer lands about the margin of the area. In the Cedros District there are patches of clay soil, especially on the Dissected Plain portion (Fig. 1). Perseverence Estate, already mentioned as the neighbor of Columbia Estate on the northeast, is located on such an area. Its name reveals the difficulties which have been experienced in the handling of this estate. In one year as much as $1,900 was spent on drainage alone,[10] and in addition cultivation is even more intensive than on Columbia Estate. That Perseverence Estate is able to yield

[10] "Cocon.ts on Clay Soils." Note in Tropical Agriculture, Vol. 1, p. 126. August, 1924

well and give a substantial income to its owner is the result of the latter's energy and ability, which qualities would have undoubtedly been still more productive had they been expended on land more favorably endowed by nature. Such estates, even if they are made to yield an adequate income in times of prosperity, represent a lack of adjustment within the Coconut District. The cost of production is increased on these clay areas not only because of the greater difficulty of securing satisfactory yields, but also because of the greater prevalence there of human diseases such as hookworm and malaria. With increasing competition for the use of the land which comes with denser population, these areas of high production cost are generally abandoned in favor of a more intensive use of the better lands.

A COMPARISON OF COLUMBIA ESTATE, CEDROS, WITH REPRESENTATIVE ESTATES IN OTHER DISTRICTS[11]

The Cocal (Fig. 2), in the Nariva-Mayaro District, contrasts sharply with Columbia Estate. Essentially it represents a natural growth with a minimum of cultivation and scientific care, but under ideal natural conditions. Coconuts produced at the Cocal are practically forest products, and the natural conditions give high yields with little effort.

THE COCAL, NARIVA-MAYARO DISTRICT

The Cocal is located along Nariva Beach (Fig. 1). It is a long narrow strip of land, at no place over a few hundred yards in width, and many miles long, bordered by the ocean on one side and the Nariva Swamp on the other. Its total area is estimated at 700 acres, practically all of which is growing coconuts, since the estate houses, the laborers' barracks, and even the oil presses and the copra drying houses are located among the palms. The trees themselves are irregularly spaced, and grow about 70 to the acre.

[11] Personal observation at the Cocal, and conference with its manager, Mr. Linton Gibbon, The Cocal, Nariva Beach, Trinidad, B. W. I.

FIGURE 10.—Navira Beach, and the Cocal. The waves are constantly cutting back the land and toppling over the foremost coconut palms. This district has the best natural conditions for coconuts in Trinidad.

The sand bar on which the Cocal is situated is so low that unusually heavy rains in the interior often cause the Nariva Swamp to overflow, cutting a temporary outlet through the bar. On the sea face of the bar is a beautiful crescentic beach of hard packed sand, a broad expanse showing at low tide, but with the waves dashing at the base of the foremost coconut palms at high water. In fact in places the waves are apparently eating back the land, a process which was reported by Kingsley,[12] and which according to the local people goes on continuously (Fig. 10).

The soil on this sand bar is of a texture excellently suited to coconuts. On the sea edge it is white in color, but becomes darker toward the swamp, and on the inner edge is black. The waters of the Nariva Swamp, fed from a large area in the Central Hilly Belt where the rainfall is over 100 inches (Figs. 1 and 3), find their way to the sea through a breach in the sand bar. A large portion of the waters, however, seep out through the loose sand, bringing a continuous supply of water, never stagnant, to the palm roots. Furthermore, these waters are highly charged with organic matter, which is left in the soil, thus constantly enriching the area from which the coconut trees derive their food supply.

The Cocal is exposed to the full sweep of the Trades, which blow at this latitude almost from the east. The maxi-

[12] C. Kingsley: *op. cit.*, p. 329.

mum amount of rainfall is found in the belt of over 100 inches (Fig. 3) which lies about five miles inland. No rainfall statistics have been kept at the Cocal, but at Manzanilla (Fig. 3) an average of 97.2 inches and at Mayaro (Fig. 3) an average of 79.6 inches is reported. The rainfall along Nariva Beach varies between these amounts. The winds blowing in from the water are, furthermore, laden with moisture which is even visible in the mist which hangs over the beach in the distance.

This dampness which characterizes the whole Nariva-Mayaro District, has two important results. First, the rapidity with which metal rusts has caused the abandonment in large part of the corrugated iron roofs which characterize the rest of the island, and the use, in place of them, of cedar shingles or of thatch from the Timit palm, both of which resist the dampness more effectively than the iron. Second, the humidity and the fewer hours of sunshine make the drying of copra in the open air more difficult, with the result that the Cocal has set up a steam drying plant, and does all of its drying by this method. Furthermore, the heavy rainfall in this district and the large drainage area from which ground water may be derived make the yield and quality of nuts much less dependent on differing amounts of rainfall than is the case at Cedros.

Malaria is common at the Cocal, as it is at Cedros. As long as the Trade wind blows in from the water, the malarial mosquitoes which breed in the swamp are not seen along the immediate coast. It is surprising, however, how soon the effect of the wind is lost after entering the palm forest: not more than 100 yards from the coast, the mosquitoes can fly at will through calm air. Also, every now and then, especially during the Rainy Season, the Trade wind dies down at night and is replaced by a gentle land breeze, and when this occurs swarms of dangerous mosquitoes are blown out from the swamps. The damp, breathless air at such times, reeking with swamp odors, is very depressing.

The exposure of Nariva Beach to the winds and waves is such that the landing of boats there is very hazardous for the greater part of the time. In fact this condition is so common that the little coasting steamer which makes the round of the island picking up freight for Port of Spain, does not stop at Nariva Beach at all, but rather at Mayaro, a little farther south. Since coconuts for export as edible nuts are very easily broken or cracked, those estates which are so located that shipment involves rough handling generally ship fewer nuts and more copra or oil. The Cedros District with its advantageous position on the calm waters of the Paria Gulf has always supplied by far the largest percentage of whole nuts for export from Trinidad. At the Cocal, the southern part is actually more accessible than the northern part. Because of this, the Cocal is administered in two parts; the southern part, south of the outlet of the Nariva Swamp (Fig. 1); the northern part, north of the outlet. The southern part produces chiefly copra and oil, and when any whole nuts are shipped as a result of unusually high prices, they also come from the southern part. The products are carried in carts to Mayaro, and there transferred to the coasting steamer. Only copra, on the other hand, is shipped from the northern part of the Cocal. This is carried in carts to Sangre Grande (Fig. 1) and thence by rail to Port of Spain. The many handlings on this route would result in very heavy losses to whole nuts.

Practically nothing in the way of cultivation is carried on at the Cocal. Along the inner edge some attempts have been made to reclaim a little of the rich swamp lands, and here a system of drainage ditches has been cut. The main part of the plantation however, needs no artificial drainage. No stock is kept at the estate, since all the work is done by hand, excepting crooking, for which donkeys are used. As a result of

FIGURE 11.—The Cocal. Coconut husks which are not used for fuel in the steam copra drying house are left in piles among the trees.

the constant fertilization of the soil by natural processes, it has been found practicable to use the coconut husks as fuel in the steam drying plant instead of returning them as mulch to the soil. With the plantation practically on the basis of a reproducing forest (Fig. 11), the chief costs of production are those of picking, manufacture into copra or oil, shipment, and overhead costs. For this reason, while Columbia Estate was producing coconuts at the rate of about $12.64 per 1,000 in the second half of 1923, the Cocal was placing its products on the market at about $8.00 per 1,000.

By a closer attention to picking methods, the Cocal increased its production in the last few years from 2,349,160 nuts in 1920–21 (July 1 to June 30), to 3,483,375 nuts in 1923–24. This represents simply the enforcement of greater care in picking, and in gathering the fallen nuts, but in no way an increased productivity. Formerly when a picker was paid by the number of nuts which he cut down, he would be tempted to cut immature nuts as well as those which were ready, and thus reduce the number of trees which he had to climb in order to do his piece of work. In Sumatra, where baboons are trained to do the picking, dishonesty of this sort is apparently avoided.[13] It is said that with scientific cultivation the yield might be doubled, but the owner feels that with the present high yields further investment would be unwise. Such scientific cultivation would include a thinning out of the trees, a careful fertilization of the soil by returning coconut husks and by manure from stock, by the care of tree wounds, and so forth. With the uncertain character of any venture in tropical agriculture in mind, the advisability of investing large sums where yields are already high might well be carefully considered.

[13] W. Grieg: "The Coconut Industry of Trinidad." West Indian Bulletin. Vol. 6, 1905, p. 149. C. D. LaRue: "Monkeys as Coconut Pickers." *Science*, N. S. 50, 1919, p. 187.

NORTHCOLE, NORTH COAST DISTRICT [14]

In the North Coast District conditions are by no means as ideal as at the Cocal. By devoting attention to proper cultivation and management, however, the estates in this district may be made to yield well. The Northcole Estate, near Blanchisseuse (Fig. 2), is representative of the better managed of these estates.

Northcole is smaller than either Columbia Estate or the Cocal, having only about 400 acres. This is a reflection no doubt of the scarcity of suitable land on the slopes of the Northern Range. Northcole borders the sea (Fig. 12), occupying chiefly the marine terrace which was previously described, and the slope of the ranges immediately in the rear of this terrace (Fig. 14). In this vicinity the Northern Range is composed of a series

FIGURE 12.—A part of Northcole Estate near Blanchisseuse. The coconut plantation occupies the marine terrace and the lower slopes of the hills behind. This northern shore presents scenes of extraordinary beauty.

[14] Personal observation at Northcole, and conference with its owner and manager, Mr. H. B. Phillips, Northcole Estate, Blanchisseuse, Trinidad, B. W. I.

of parallel ridges, the main one being separated from the Blanchisseuse coast by three lower ridges. The streams draining from the main ridge cut through the lower hills in a series of water gaps. The main ridge rises to an elevation of over 3,000 feet in its highest peaks, and the passes are well over 2,000 feet above sea level. Also the valleys are steep sided and narrow bottomed, the slopes clothed with the dense vegetation of a rain forest, and the divides themselves sharp and crumbling, which makes communication across the mountains very difficult. An automobile road has been built to Toco (Fig. 3) around the eastern end of the range, but otherwise only trails reach this District.

The heavy rainfall along this coast (Fig. 3) and the steep slopes of the coastal ridge combine to insure a good supply of ground water, with a rapid flow. The soil on the marine terrace is a black sandy loam, well suited to a rapid percolation of the ground water. However, there are patches of sticky clay soil along the terrace, and in the water gaps where the streams from the interior cut through to the coast, and here coconuts do not do so well. This heavy rainfall, moreover, insures a constant supply of water, so that slight variations in the amount of fall are probably not as important as at Cedros. No rainfall statistics, however, are available to prove this point.

Since the winds blow parallel to the coast, the little swampy bays are protected from their influence, and in these bays one finds a steamy humidity and an abundance of malarial mosquitoes. Unfortunately most of the early native fishing villages along this coast were located in the valleys where a protected landing for boats could be had (Fig. 13). Among the natives malaria is very common. The coconut estate buildings and most of the newer settlements are located on the surrounding hills exposed to the winds.

FIGURE 13.—Sans Souci Bay. In these little swampy bays, protected from the winds, the original native fishing villages are located. Malaria is very common in them, so that the coconut estate buildings are now built on the hills where the drainage is good, and where the winds reduce the mosquito menace.

Because of the difficult accessibility of the North Coast District, its products reach Port of Spain by the coasting steamer rather than overland. The

rough handling of the products incident upon the transfer from the coast to the lighters, and from the lighters to the coasting steamer, makes the shipment of whole nuts unprofitable, so that copra is the chief product sent out.

Unlike the Cocal, scientific management is necessary for high yields in this district. At Northcole, much attention has been paid in recent years to cultivation methods. Drains have been dug to aid the flow of ground water; the husks have been carefully used for mulch; weeds, which spring up very quickly in the moist climate, are constantly cut back, and tree wounds are cared for. The cost of all this is estimated at $11 per 1,000 nuts, as compared with the figures previously given for Columbia Estate and the Cocal.

FIGURE 14.—The rear of the owner's house, Northcole Estate. The corrugated iron roof is closed on rainy days, but on dry days the roof is pushed aside and copra is spread on the platform. Also a sanitary water supply is collected from the roof, through the long gutter to the cement tank in the foreground.

The copra at Northcole is dried in the sun, there being a sufficient number of hours of sunshine in this district to make this economical. The roof of the owner's house is used for this purpose (Fig. 14). In wet weather the corrugated iron roof is closed and the rain water is collected through the gutter in the large concrete tank at the side of the building. This water is safer for drinking purposes than the stream water, and because of the heavy rains can be depended upon for the year's supply.

Northcole enjoys one practice which places it on a far safer economic basis than most of the other Trinidad estates. It produces in addition to coconuts, some cacao and coffee. This is largely the result of areas of clay soil unsuited to coconut cultivation in places protected from the high winds, and to a manager with sufficient foresight to grasp the opportunity thus offered him to distribute his risk in several products instead of one. The coffee is grown in hedges between the coconut fields. However, no stock is carried at Northcole, due to the lack of suitable land for pasture.

PLANTATIONS IN OTHER PARTS OF THE ISLAND

Outside of these three districts, there are only a few limited areas where conditions are favorable for coconut cultivation. Most of the estates elsewhere on the island are maintained only with great trouble and yields from them are low. Many of these other estates are located in the sugar or cacao districts, in many cases only as temporary cover for idle land, or to aid in the distribution of risk. The practice is sound in these cases, even if the land is not ideally adapted to coconut cultivation. However, many of the plantations are kept only for coconuts and represent a very hazardous speculation. With increasing economic pressure for a more effective use of the land, these other plantations will probably largely disappear.

The coconut plantation in the Diego Martin Valley may serve as an example of this type of estate. Diego Martin valley is a basin-like valley in the Northern Range, a little west of Port of Spain (Figs. 1, 2, and 3). In spite of serious attempts to make this estate yield well by many forms of cultivation, it has always done poorly. Its trees are obviously in poor condition. Red Ring is very common. Yet when prices are high this plantation provides a very satisfactory income. It is located in an area of clay soil, through which the ground water penetrates only with the greatest difficulty. Often after a rain the water

ponds on the surface. A coconut estate on such land is plainly a case of maladjustment.

CONCLUSION

From a consideration of the Trinidad coconut industry, three stages may be suggested in the adjustment of the industry to the geographic conditions. In the early days, the area most suited by nature for the production of coconuts was used for that purpose, and coconuts were very rare outside of that district. This we may call the first stage. With the increase of population on the island, the development of markets for coconut products elsewhere, and the establishment of ocean transportation, it became profitable to plant coconuts on land normally unsuited to them and there to reap the reward of the speculative high prices. The tremendous fluctuations in price tempt the planters to maintain estates on poor land during a period of low returns, and attract many new comers during boom years. Such fluctuations as have taken place recently (from $24 per 1,000 nuts in August 1923 to $40 per 1,000 in August 1924, at Panama[15]) also tend to discourage sound investment. This may be called the second stage; and Trinidad is entering this second stage of development. The ultimate stage may be predicted from studies of other regions which have already reached it, or, as in parts of the United States, are approaching it. With increasing economic pressure, the industry will tend to retreat from the poorer lands, and increase production by a more intensive use of the better lands. This third stage is not near at hand in Trinidad; and the sharp increases in price are as dangerous and unsettling as sharp decreases, since they stimulate the planting of coconuts on low grade land, and therefore retard in such regions as Trinidad, the trend toward a closer adjustment to geographic conditions.

[15] Correspondence with Bureau of Foreign and Domestic Commerce. Washington, D. C.

FIGURE 15.—A thicket of coconut trees on an estate in eastern Trinidad.

BOOK REVIEWS

Economic Atlas, Putnam's; A Systematic Survey of the World's Trade, Economic Resources, and Communications. Issued under the auspices of the Association of British Chambers of Commerce, and edited by GEORGE PHILIP and T. SWINBORNE SHELDRAKE. ix and 112 pp., maps and textual description with charts and graphs. G. P. Putnam's Sons, New York, 1925. 16 x 11 inches.

Putnam's Economic Atlas is one of the very few among the several commercial or economic geography atlases printed in the last quarter century which are of international importance. It is one of those great mothers of geographic knowledge, carefully assembled, digested, and presented, from which a whole brood of legitimate and illegitimate progeny springs. It belongs in the same class with Bartholomew's "Atlas of the World's Commerce" of English origin, and with Baker and Finch's "Geography of the World's Agriculture," and the Geological Survey's "Economic Geology; Minerals and Water Power," two American publications which together constitute three parts of a general commercial and industrial atlas.

Putnam's Economic Atlas has successfully combined the characteristics of both these English and American atlases, and included the best features of Philip's comparative maps of commercial development as well. A superficial examination gives the impression that this new atlas closely resembles the promised revision of Bartholomew's, for which geographers have expectantly waited these many years; but closer inspection reveals that instead of the relative method of Bartholomew's Atlas, the more accurate absolute method used in the American government atlases has been adopted.

A comparison of these two methods of statistical presentation forces the conclusion that the absolute method illustrated in the American government atlases is superior to the relative method illustrated in Bartholomew's Atlas; but the American atlases are open to the criticism that the exact distributional function has not been so scrupulously expressed as has the quantitative—that is, the size of the dots and squares to represent quantity has been more carefully presented than has their location to indicate placement or distribution. The Swedes, pioneers in the absolute method, emphatically assert that unless the smallest regional unit data are employed, or a geographer personally acquainted with the regional distribution of the sources of the data supervises the cartographic work, the so-called absolute method becomes merely relative after all. In this respect Putnam's Economic Atlas, like the American government atlases, suffers from inadequate or questionable statistical and distributional data from remote or backward countries.

An illustration of the unavoidable inaccuracy of the so-called absolute method may be found in a comparison of the wheat map of China given in this Putnam's Atlas, pages 24 and 25, with O. E. Baker's wheat map of the same country, found in ECONOMIC GEOGRAPHY, 1925, page 29, by which a striking dissimilarity in distributional extent is revealed, undoubtedly due to the use of inadequate or inaccurate statistical data, and to large regional units, by one or the other author, or both.

The Putnam Atlas embodies a most distinct improvement over any hitherto published of statistical data, in that a projection, quite similar to the Goode Homolographic projection, has been employed, whereby the relative density or sparseness of distribution is uniformly and accurately represented in all latitudes, extreme temperate as well as tropic. Such accuracy of comparative distribution is not possible with the Mercator and other projections used in former atlases.

Very evidently the maps of the atlas have been prepared from the most recent official and statistical data extant; they seem to bear out, more fully and truthfully than most books do, the statement of the preface as follows: "The compilation of the Putnam Atlas has involved laborious research in all available British and Foreign Trade Returns and Reports and other official publications dealing with specific commodities and economic subjects generally." Throughout the preparation of the atlas the Association of British Chambers of Commerce, under whose auspices it was issued, has coöperated in every way possible in supplying all required information and details; the British Department of Overseas Trade particularly, and other British and Foreign departments as well, have helped furnish data and information to amplify the knowledge presented. By this laudable interest and coöperation from all trade and commerce organizations, the atlas has been made the most satisfactory source compendium yet published, for all commercial and industrial groups, and for all teachers and students who make the realm of trade and commerce their field of investigation and activity.

The "Reference Index" of the atlas is another highly valuable feature. Every item of raw materials or manufactured goods dealt with has been indexed by the ingenious "K" Dual Classification of Commodities devised by Admiral H. H. Campbell, a system of particular advantage to merchants and shippers; for their convenience the form of this index is given in the atlas, as well as an alphabetical index.

The Atlas is divided as follows:

1. Introductory maps and diagrams;
2. Communication and Transport;
3. Commodities of Commerce;
4. Commercial Development of the Principal Countries;
5. Commercial Compendium.

The first section, "Introductory Maps and Diagrams," is concerned with world relationships and world conditions. The maps show political divisions, lines of transportation and communication, occupations and distribution of peoples, British and American diplomatic and consular representation, foreign trade bourses and financial exchanges, and distribution of water power. While on the whole the maps of this section are satisfactory, one in particular may be justly criticized, that of "The Occupations of Mankind"; for though in spite of its relatively small size it does show man's occupations, or rather his utilization of the land, rather well, it fails to agree strictly with the introductory statement which avers that "Throughout, features of subordinate economic interest are shown in light gradations of color; stronger shades of coloring being reserved to illustrate commercial information of major importance." This disagreement is most marked in making heavy dark brown, as in Scandinavia or Ontario, the color for forestry and lumbering, which are relatively unimportant in contrast with intensive agriculture and plantation cultivation, indicated by a light green color, even in Denmark and eastern Pennsylvania. Likewise stock raising, shown in sharp orange, is represented more important than agriculture.

The second section on "Communications and Transport" is devoted to the trade routes and cable lines of the oceans and seas of the world, and to land transportation facilities, particularly of Europe. This section is quite satisfactory and exceedingly valuable to trade and commerce, especially since each great ocean is represented on its own large map; not often are good maps of the oceans as distinct entities adequately represented, as they are in this atlas.

In the "Distribution of the Commodities of Commerce," the third section, these commodities are classified in four groups: vegetable food products; animal food products; textile materials and miscellaneous plant products; and mineral products. The maps of this section are probably the most interesting of the atlas, despite their similarity to those of the American government atlases, which, however, present older data.

The remaining map section, the fourth, "Commercial Development of the Principal Countries," closely resembling Philip's "Comparative Maps of the World," is most important of all, in that only the maps which comprise it present detailed regional information. Not elsewhere in the volume is this information given. The base coloring of these maps depicts the land utilization in a region, but not always successfully, for colors so slightly different are used to represent crops and forest that great care is needed to distinguish them. In the map of Germany for instance, the general green color gives the impression that forests still cover almost the whole area, whereas statistics prove that 43 per cent of the land is devoted to crops; other maps of industrial parts of Germany in the atlas on a larger scale, show at a glance more clearly and correctly the true situation, because in them the cultivated lands are represented by a distinct yellow. Similarly these same green colors used in the map of England make that country appear to be wholly crop land, whereas the latest statistics published by the International Institute of Agriculture in Rome indicate that crop land and woodland are almost equally extensive; yet if the map of "Distribution of Timber and Wood Pulp" were accepted as the criterion, the whole of Great Britain would be considered forest and woodland. Evidently there is little complementary cartographic coördination in two such maps.

The fifth and concluding section of the atlas, the "Commercial Compendium," twenty-five pages of textual matter supplementary to the text accompanying each map in the "Commodities of Commerce" section, constitutes, with these map texts, a comprehensive digest of all commodities entering into international trade. These final 25 pages comprise accounts of all those minor, secondary, or subordinate commodities not important enough, or valuable enough, to be shown on the maps. The methods of cultivation, production or preparation for use are all described; the main sources of supply are related; the chief types and grades, the technical and trade names in use, the systems of marketing adopted, the processes of manufacture, if any, and the uses of any by-products, are all enumerated.

Apparently the compendium is generally accurate and correct, as are the maps; but attention may be called to some few errors, discrepancies, and ambiguities, as follows:

On page 27a "Europe grows the two-rowed barley for malting and six-rowed for feeding, as a general rule" is a statement that should be challenged. Six-rowed barley is grown in the polar barley region as a bread cereal, where other small grains can not be successfully grown because of the short growing season, and consequent damage from early fall frosts. Two-rowed barley, grown most for malt and feed purposes, yields well, and like wheat and sugar beets is grown most successfully on deep, fertile, calcareous loamy clay soil. These two species of barley differ more than rye and wheat.

On page 27a again "Barley is an export grain in Russia, and must be grown near the coast," is erroneous and misleading. Barley is grown as a dominant crop in Russia near the large seas, the Caspian and the Black, because it can be grown here, as elsewhere in the world, more successfully

than other grains in the semiarid transition zones bordering the deserts, due to its shorter growing season.

On page 29a "In the United States, the young head (of maize) is eaten as a vegetable" and "Popcorn is roasted maize covered with syrup" are two statements that, aside from the rather amusing errors due to ignorance of the actual facts, must be disputed because distinct species of maize, as different from ordinary maize as two-rowed barley is from the six-rowed species, are described.

On page 37a, "In Java, Coffee robusta, an African type, is becoming important," the statement is made in connection with the coffee-rust of Ceylon. The fact is that Coffee robusta is a hybrid between *Coffea arabica* and *Coffea liberica*, and because this cross, like *Coffea liberica* itself was "robust" or resistant against the rust it was called *Coffea robusta*, and is now the mother species of many varieties now grown in the East Indies.

These few misstatements are somewhat trivial but they are illustrative of many others, too many to ignore altogether, even though the general excellence of the compendium more than compensates for them.

Even a cursory examination of the maps reveals a few errors, but very few more can be discovered by careful study. On pages 15–16a, Sweden's and Norway's waterpower has been indicated by too large units on the world map. Norway's developed water power is shown as slightly more than 5,800,000 horsepower, and Sweden's as slightly more than 5,400,000. The figures ought to be 1,820,000 for Norway and 1,420,000 for Sweden, as indicated by inset maps and diagrams that accompany the larger map. On pages 32–33a, why should the political boundaries be shown in red for Central Europe on the wine map, and not for the rest of the world? On pages 38–39a, the world map indicates 15,000,000 cwts. of potatoes for Norway but none for Sweden, while the inset map shows 1,000,000 cwts. for Norway and 30,000,000 for Sweden.

All these few errors in text and map, and shortcomings in cartographic methods, are negligible in consideration of the uniform standard excellence of Putnam's Atlas as a whole, without doubt the best of its kind in the world up to the present time. The various maps are of inestimable value for the economic and commercial interests of the world; and the compendium of the commodities of commerce ("Warenkunde" of the Germans), the most compact and comprehensive thus far compiled, constitutes a most important addition to general commercial knowledge. Most successfully are statistics and distribution blended with description, to form a single entity of geographic knowledge, most valuable to international business and commercial training.

OLOF JONASSON.

The Transactions of the First World Power Conference. Volume I. Power Resources of the World, Available and Utilized. Volume II. Water Power Production, Preparation of Fuels, Steam Power Production. Volume III. Internal Combustion Engines, Gas and Fuel Section, Power from Other Sources, Power Transmission and Distribution, Standardization and Research, Illumination. Volume IV. Power in Industry and Domestic Use, Power in Electro-chemistry and Electrometallurgy, Power for Transport, Economic Aspects of Power Resources, Education, Health, Publicity. Volume V. Index. 1506, 1599, 1502, 1816, and 590 pp.; maps, charts, diagrams, illustrations. Percy Lund Humphries & Co. Ltd., London, 1925. 10 x 6 inches.

This magnificent compilation of papers on the power resources of the world, submitted to the First World Power Conference in convention assembled in London from June 30 to July 12, 1924, is probably the foremost contribution of the year to economic geography. It presents for the first time in adequate treatment the primary significance in the world's industry of the sources of energy, the power needed to drive the world's great machines, to propel the world's great steamships, to turn the innumerable spindles and push the multitudinous shuttles of the world's great textile mills, to spin the dynamos and motors of the world's great electric plants, to smelt the world's ores and mold them to the world's machinery, and to fashion the world's raw materials to man's food, and clothing, and shelter, his needs, his comforts, his amenities and business of life. This study of the distribution of the sources of power, and its relationship to man's activities opens up a field to the economic geographer, a field in which new relationships between man and his land may be developed and promoted.

Twenty-three nations of the world are represented on the Executive Committee of the Conference, every nation that uses power to any significant extent; and over forty political divisions sent delegates, men of widest vision, keenest intelligence, and most accurate knowledge of the field. For two weeks the delegates heard the reports, deliberated the plans proposed for international development and utilization of the world's power resources for the good of the peoples of the whole world, and concluded their conference with the formulation of a constructive program of procedure which must stand as a milestone in the way toward coöperation and concerted action among all the diverse peoples of the world with their divergent interests but convergent hopes for peace and prosperity. It marks a scientific station far in advance of political progress, a goal for the efforts of the world's statesmen.

Volume I. "Power Resources of the World Available and Utilized." This initial volume of

the report is a geographic survey of the power resources of all countries represented, a summary of the present and potential utilization of all the sources of energy. Almost 500 pages are devoted to the British Commonwealth of Nations; 80 to the United States; 150 to Russia and Siberia; and proportionate space to the several other countries, all in general exhaustively treated.

This volume is of particular value to the economic geographer. Excellent maps, charts, and illustrations accompany most of the articles, and a mass of descriptive and statistical material helps to elucidate the power situation in every land. Certainly no teacher of the subject can fail to acquaint himself with the wealth of factual material presented, or the points of view that may give him a truer perspective of the whole field of man's activities and adaptations.

Volume II. "Water Power Production, Preparation of Fuels, Steam Power Production." Less generalized, more specific and technical than the first volume, this second volume is nevertheless of almost equal significance to the economic geographer. The relationship of the physical factors—location, relief, climate, natural vegetation, and mineral deposits—to the method and extent of power utilization is both directly and indirectly presented; the economic factors are likewise considered often at considerable length.

Like the first volume, the second is well illustrated, and contains so much of factual value that may well be included in the geographer's fund of information that the profession dare not omit it from the working libraries or the courses of instruction, if geography would keep pace with the progress of the world's affairs.

Volume III. "Internal Combustion Engines, Gas and Volume Section, Power from Other Sources, Power Transmission and Distribution, Standardization and Research, Illumination." The subject matter of the third volume is decidedly technical and of much more interest to the engineer than to the geographer; yet by inference and deduction the latter may find many relationships and connections with his own field, while the former may certainly realize the influence of geographic factors in the problems he has to solve. Thus, for instance, the problems of transmission and distribution of power involve both geographic and engineering functions, as well as due regard for economic factors. The frequent use of maps to illustrate the volume is a criterion of the significance of location, relief, and climate in even so technical a phase of the field covered. The maps of the electrification of the Netherlands are fair examples of this criterion, interesting indeed from the geographer's point of view.

Volume IV. "Power in Industry and Domestic Use, Power in Electro-chemistry and Electrometallurgy, Power for Transport, Economic Aspects of Power Resources, Education, Health, Publicity." This final volume of text, a volume dealing with the application of power to man's activity, and its consequent effects upon the final expression of man's development—his industrial and cultural utilization of this factor in his habitat, this most recent phenomenon of his adaptation to his environment—is almost romantic in its treatment of the subject. With little imagination the geographer sees a vision of a superb new future with synthesis of foods, transmutation of elements, illimitable application of energy—electrical, radiant, and all the forms—to activities now beyond the horizon of his ability. What interesting possibilities lie behind such titles as "Legislation concerning the power policies of Rumania," one of the chapters in this volume! or "Psychotechnics in Holland"! or "The Influence of Broadcasting."

Volume V. Index. Not a perfunctory compilation of titles and subtitles, but an accurate, authentic, complete list of every subject discussed in the 7000 pages of this monumental series, this volume will delight the research worker in Geography who must delve among the deep sources of fact and truth for the relationships and adaptations that are his own particular field.

W. ELMER EKBLAW.

COPELAND, EDWIN BINGHAM. *Rice.* 352 pp.; 28 plates, 4 colored. 1924. MacMillan and Co., London, New York. $6.50.

In the introduction, the author concludes from combined botanical and linguistic evidence that rice culture began in southeastern Asia.

Chapter I, "The Botany of Rice," is much more inclusive than might be suspected from the title. There is a non-technical botanical description of the plant arranged from the agricultural rather than the botanical standpoint and containing much more than descriptive botany. There is a full discussion of germination and of the factors affecting it. The description of shoot and root are amplified by a discussion of the nature and scope of vegetative growth (illustrated by 6 graphs in color), the absorption of various substances from the soil solution and something of metabolism. A table of correlations of genetic and physiologic characters is given. The chapter ends with a discussion of the phenomena of flowering and fruiting.

Climate, soil and water are discussed in Chapter II. Rice is grown but little commercially above 40° of latitude. Varieties are exceedingly numerous and differ greatly in response to environment, but little is known of the physiology of the plant. It may be grown in either a wet or a dry climate provided sufficient irrigation water is available. Rice is characterized by a great need of water, a little need of oxygen and the ability to use ammonium rather than nitrate nitrogen. Heavy soils are best suited to rice because poorer soils leach rapidly and also allow irrigation water to escape rapidly. Earliness of maturity is only relative, being changed by environmental conditions.

Chapter III discusses diseases and pests of rice. The author calls especial attention to the possibility of severe destruction of rice when a pest is imported to a new country where it has fewer natural enemies. The author discusses certain diseases of non-parasitic origin and then separates those caused by organisms into four groups, namely: A, fungi; B, worms (nemas); C, insects, and D, other animals (snails, rodents and birds). Numerous fungi, mostly imperfect, but including a few rusts, downy mildews and smut, are discussed as to vernacular names, nature, distribution and destructiveness of the diseases they cause and methods of control. Insect pests are discussed in the same way and some are illustrated in two colored plates. The occurrence of a parasitic weed, *Striga*, in Java, is noted.

In Chapter IV seed and varieties of rice are discussed. No problem is more important than that of good seed. Rice being highly specialized, varieties should not be brought from a distance except for experiment. Choice of varieties is governed by local conditions, including market. Varieties exist in enormous numbers and show the same diversity in size, form and color of parts and in response to environment as do the varieties of other cereal grasses. The direction and extent of variability in many of the organs are pointed out.

The difficulties of classification of rice varieties are discussed and the author suggests a form of key. In it he first separates varieties having plural kernels, plural spikelets, or floating habit. He then would separate the remaining ordinary rice successively by kernel color, glume length (3), hull (lemma and palea) color (3), sheath color, ligule color, glutinousness, awnedness, water requirement (upland or irrigated), kernel length (5), lemma and palea convexity (5) (see plate) and kernel texture (4). The numerals in parentheses indicate the number of subdivisions where more than two. No attempt is made to classify varieties but the formulas of a few important American varieties are given.

The chapter closes with a discussion of methods of improvement, covering variability, running out, rogueing, mass selection especially as practiced in Italy, pure-line selection in different countries, and hybridization. Among dominant heritable characters are white glumes over red, black hulls over white, starchy endosperm over glutinous, short glumes, short panicle, clustered spikelets, red awns over white and purple awns over red.

Chapter V discusses rice in the United States and is illustrated by eight half-tone plates, mostly of methods of land preparation and rice growing. The United States differs from other rice growing countries in the high cost of labor and the consequent extensive utilization of machinery. An extended discussion is given of rice production in California where the author now is commercially engaged. The chapter covers history, climate, soil type, land preparation, varieties, seeding, irrigation, weed control, harvesting, curing, marketing, cost of production and means of improvement, including rotations. Special emphasis is laid on the differences in practice in growing the first and subsequent crops, and on weeds and weed control, especially by submergence. Running comment is given on crop losses, their causes and remedies. The shorter sections on Carolina and the Gulf States recount the history of rice growing there and explain the differences in cultural practices.

Chapter VI is concerned with rice in the Philippines. This is chosen for extensive discussion because of the author's personal familiarity with Philippine rice, due to many years of residence and investigation there and to the fact that the extensive investigations made provide a sound basis for discussion of the means of improvement in which Philippine rice growing is used as an example of oriental practice. Five methods of growing rice are discussed. The first is the method of growing in poorly tilled forest clearings which are presently abandoned, a practice of hill-dwelling peoples. The second is the growing of upland rice, that is, without irrigation, as other cereal crops are grown. Poor crops result but are produced at low cost and in rotation with other staple crops. The third method is broadcasting, resembling the upland culture in that the seed is sown directly on the field where the crop is to be grown, instead of being transplanted. It is afterwards irrigated. This practice obtains chiefly where irrigation water is limited. The fourth and most important method is the growing of lowland or ordinary irrigated rice. As elsewhere in the Orient the seed is sown in especially prepared seed beds from which the young plants are transplanted by hand labor to the larger fields. The area of the seed bed is usually about 1/25 that of the field to be planted. The seed bed, preparation for seeding, care of the seedlings, field preparation, transplanting, irrigation, hand harvesting, primitive threshing, threshing and milling are described, and many of the processes and implements illustrated in six half-tone plates. A brief discussion and one half-tone illustration are given of the growing of Igorot rice on terraced mountainsides. Means of improvement are discussed under better seed, better varieties, better irrigation, fertilizers, rotations, rural finance, and use of more animal labor and machinery, especially plows and drills. The author does not believe that the use of binders, or separators, would be profitable under Philippine conditions.

Chapter VII discusses rice in other lands. Brief or more extensive accounts are given of rice production in Indo-China (including the singular floating rice of Cambodia), Siam, India (Burma, Bengal, Bombay, Mysore and elsewhere), Ceylon, British Malaya, Java (where

hand operations in rice culture are greater than in other countries), China (with her meticulous care in fertilizing her ancient fields), Japan (where methods still are crude but much physiological, botanical and genetic research on rice has been accomplished), other Asiatic countries, Africa, Latin America, Spain and Italy, concerning which he quotes extensively from Professor Novelli. Goldfish for food are raised in the rice fields of Java, and carp in some Italian fields. Some wheat is broadcasted in the Italian rice fields before rice harvest.

In Chapter VIII the uses of rice are discussed. Annual world production is estimated at 446,000,000,000 pounds of rough rice against 276,000,000,000 pounds of wheat. (In terms of bushels of 45 and 60 pounds respectively, these would equal, roughly, 10 billion bushels of rice and 4.9 billion bushels of wheat. C. R. B.) The milling processes are described and diagrammed and the products named. Average composition is given. Brown rice, that is, rice with only the hulls removed, is recommended for food. Cooking rice so as to keep the kernels distinct, the use of rice flour, the nature and use of glutinous rice, and rice starch (the basis of the face powder industry) are discussed. The production of fermented and distilled drinks is mentioned. Rice bran and polish are concentrated feeds, the hulls may be used for fuel and the straw for fertilizer, paper (not the so-called rice paper, however), and mushroom beds.

The final chapter, entitled "General Conclusions," is an economic discussion of commerce, cost of production, status of rice growers, rice and population, and malaria. The author points out that rice growing in the Orient is the work of the great middle class, not of the poor as commonly alleged. He cites the heavy investment required on rice land in the form of dikes and canals, and not removable or usable for other crops, as rendering the population immobile and compelling a peaceful attitude in life. Hence rice-growing peoples are not given to warring, which helps to explain density of oriental populations. An eight-page index completes the book.

The work is readable. The style is clear and there are remarkably few errors in diction or typography. The paper is good, the makeup usually excellent and presswork equally so.

One important omission is the failure to number the plates, or their component figures in most cases, or to refer to them in the text. Common names of rice varieties are printed in italics and usually only those derived from proper names are capitalized, thus violating both botanical and agronomic usage. The English spelling of "favour," "colour," etc., results in a curious error on page 137, where the Latin varietal name is spelled "*discolour*." "Shiny" is used for "shining" throughout. The description of the ligule on page 111 is likely to be somewhat misleading. Chapter titles are in relatively small type and centered first-rank subheads appear in the same type on pages 165, 207, 208 and throughout chapter 7, and in still larger type on pages 333 and 340. A second-rank subhead appears in the same type on page 203.

CARLETON R. BALL.

JONES, D. RODWELL, and BRYAN, P. W. *North America; an Historical, Economic, and Regional Geography.* xiii and 537 pp.; ills., diagrams, maps, charts, and index. The Dial Press, Inc., New York, 1924. 8½ x 6 inches. $5.00.

A long-range perspective, a detached viewpoint, and a treatment unbiased by local or sectional influences distinguish this excellent text book on North America from a number of other excellent text books on the same subject that have been brought forth by American geographers within the last decade. It is unique in its organization of the rich textual content, and commendably careful in its selection of material.

The first fourth of the book, some 135 pages, is devoted to "Historical Geography," in which the clear-cut effect of the physical factors upon the exploration and occupation of the virgin continent by old-world peoples is most vividly presented, and the major responses of the first colonization projects and the later nationalistic expansion to the natural elements in the new land, are strikingly portrayed. Professor Rodwell Jones is the author of this carefully prepared part of the book, so essential to the two sections following.

Dr. P. W. Bryan writes all of the second part, "Economic Geography," except the first chapter, which deals with climate. This highly interesting section of the book, 175 pages, is a painstaking compilation of the salient industrial facts and features of the continent, and their correlation with the physical factors to which they owe their origin and their development. Cotton, wheat, maize, coal, iron and steel, oil, and nonferrous metals, sulphur and phosphates are exhaustively treated.

The third section of the book, "Regional Geography," 200 pages, by Professor Jones in its entirety, is of the same high character as the rest of the book, and reveals an acquaintance with the geography of the continent that comes only after years of close study. The human activities that distinguish or characterize the several regions treated are uniformly well interpreted as functions of the physical and economic environment.

The book suffers from the very weight of the textual material presented, and the monotony of page after page of solid reading matter. Even the most mature and well-disciplined reader finds it tedious to pore over the mass of factual substance borne by each chapter; and the immature student between grammar school and university ages for whom the book is specially prepared would probably rebel from sheer weariness.

Yet so rich a harvest of knowledge and real understanding of North America is the reward of diligence and persistence in completing the task—for task it is—that every one would do well to keep at it until he has carefully read every page.

W. ELMER EKBLAW.

GILBERT, ARTHUR W. *The Food Supply of New England.* Prepared under the auspices of the Executive Committee of the New England Agricultural Conference. ix and 273 pp.; addendum. The MacMillan Company. New York, 1924. 5½ x 8 inches. $2.00.

The Food Supply of New England, edited by Arthur W. Gilbert, Massachusetts Commissioner of Agriculture, is a brief and general survey of the complex question of New England agriculture with particular reference to the food supply of New England, a question which has a direct bearing not only upon the agriculture of the region but upon every phase of New England life. The persons who have contributed to the volume take cognizance of the major handicaps under which New England is laboring on the one hand, and of her special resources and advantages on the other; they emphasize the evolution in New England agriculture, the general food situation, and their influence on the manufacturing industries.

At the present time New England is producing less than one-fourth of the food it consumes or less than one-half of the food of Massachusetts. Massachusetts raises only enough vegetables to feed herself from eight to twelve weeks, sufficient poultry and poultry products for six to ten weeks, enough potatoes for three to six weeks, sufficient hogs for about a week, enough sheep for one day, enough beef for only one or two meals, and butter sufficient to spread her bread for only one meal. For dairy products, important agricultural commodities of New England, Massachusetts has to look beyond the boundaries of the region for an adequate supply. Boston alone receives 11 per cent of her cream and 15 per cent of her milk from Canada and 9 per cent of her cream and 18 per cent of her milk from New York. This condition alone might not be a serious disadvantage, but considered in relation to the manufacturing industry, the financial backbone of New England, it becomes significant.

"It is not alone the increasing costs of securing raw materials here for our factories that is making it hard for New England industries to compete with those in other parts of the country. It is also largely the competition of labor. High cost of living makes labor dear. Expensive labor reduces profits to narrow margins. Labor will migrate to places where living is cheaper unless high wages are kept up and the high standards of living to which it is accustomed are maintained."

Statistics show that the number of spindles in our cotton factories has increased 45 per cent in the last ten years, while in the South it has increased 345 per cent. In New England 38 per cent of the cost of living is that of food. It costs the average workingman's family in Massachusetts about seventy-five dollars more a year for food than in the states of the South and West. This amount multiplied by the number of working families in this state gives a cost of about $50,000,000 more for food alone than in competing industrial areas.

These striking facts presented in *The Food Supply of New England* bring the people face to face with the needs of the region. The chief needs of New England at the present time are (1) A thorough investigation of her natural resources—relief, climate, soils, coastline and vegetation—in relation to the economic conditions of her leading industries in order that a more perfect utilization of her resources can be made, and (2) A study of coöperative production, distribution, and marketing. As indicated by this volume, the movement is already on foot and with adequate and proper direction New England can go far to overcome some of the difficulties into which she has drifted.

CLARENCE F. JONES.

VON ENGELN, O. D. *Inheriting the Earth; or The Geographical Factor in National Development.* xvi and 379 pp. The MacMillan Co., New York, 1922. 8 x 5½ inches. $2.00.

The time is opportune to recall to the attention of the geographer and the economist the very worth-while matter of this book, written "not so much to show that human organization and development *have* been determined by geographic conditions, as to insist that in the future they *should* be." In every industry, in every activity, in almost every relationship of life, the environmental factors that influence the direction and progress of man's advance toward a better, surer, more successful adjustment to his dwelling place, are being studied more closely, are being more fully recognized in their tendencies and their effects than ever before; and this book helps specifically toward a reasonable point of view.

Professor Von Engeln writes clearly and fluently. He writes practically and without bias. He writes logically and convincingly. He begins with the very self-evident dissimilarity of nations; discusses the relationship between the land and the people, the nation and the place, the individual and the nation; contrasts international anarchy with international amity, and independence with interdependence of nations; and then finally in three deeply interesting, informative, illuminating chapters presents forcefully the profound effect of physical factors—and economic factors founded in the physical—upon man's development of temperate lands, and his conquest of the tropics.

The whole message of the book is aptly summarized in a paragraph from the preface:

"The peace, prosperity, and progress of all the world, and the spread of civilization to all its parts, will be most rapidly and surely attained

when once the idea has become generally accepted that all men will profit most by permitting and encouraging everywhere the most effective utilization of natural resources. Only by that means can the maximum production of all commodities be secured. This may seem a very materialistic concept of human destiny, but it should not be forgotten that only after man's needs are supplied can he give time and energy to study and contemplation. The future of nations is assured when they have learned to inherit the earth and the fullness thereof."

It is a book for the layman, for the "average citizen" as well as for the geographer and the economist. Everybody who reads it will profit by so doing. It should be in every man's library.

W. ELMER EKBLAW.

CAMPBELL, C. G. *Commonwealth; A Study in Social Philosophy.* xii and 472 pp. The Century Company, New York, 1925. $3.00.

The author of the work under review essays to present the "wealth phenomenon" in a manner so simple that it may be grasped by the "average intelligence"—a worth-while ambition, common to most writers in the field. To attain this objective in the manner attempted by the present author, appears to the reviewer as a forlorn hope; to reject the painfully worked out and at least approximately accurate technical vocabulary of the science of economics in favor of a new terminology leads to confusion, rather than clarification. Land, labor, and capital are definite and established working concepts in the minds of most economists, and the author has made no new discovery when he asserts that "land" is more than *terra firma*, or that labor may be mental as well as physical (p. 51 ff.). "Material source," "energy plant," "preëmptive sustenance commodities" (*i.e.*, necessities), and similar frequently used unique abstractions are questionable substitutes for terms already fairly well accepted and understood.

The author's insistence on the essential communal nature of wealth, however owned and controlled, is commendable. Also, Book III, the best part of the work, entitled "The Broad Questions of the Dual Economy," presents some ethical aspects of production, accumulation, and utilization of wealth, which all members of economic society should appreciate more keenly.

On the whole, however, the book is laid aside with a feeling of relief rather than of enlightenment.

S. J. BRANDENBURG.

SMITH, J. RUSSELL. *Industrial and Commercial Geography.* vii and 959 pp. Illustrations, diagrams, maps, index. Henry Holt and Company, New York. Revised edition, 1925.

This volume, which has been a standard text of economic geography for twelve years, now appears in revised form. It is far superior to the old edition from the standpoint of illustrative material. It contains 17 new pictures and 60 some other new illustrations, about half of which consist of black and white dot maps from publications of the United States Department of Agriculture. Furthermore, the old graphs have been improved and brought down to date. While this new material has strengthened the volume, no direct reference is made to the figures in the text to clinch a point in the discussion or to direct the study of students along certain lines. In some cases the banal captions to the figures (Figures 34, 37, 116) detract from the excellent material shown, and in others the inaccurate titles (Figures 39, 196) lead to erroneous conclusions.

The text has also been revised, the discussion and the statistics bringing in new developments and new points of view. The influences of the world war, the ravages of new insect pests, and advances or reverses in various industries owing to changing economic conditions appear in short salient paragraphs added throughout the book. *Industrial and Commercial Geography*, so long a standard text, will continue to be used widely after this thorough revision.

CLARENCE F. JONES.

Handbook of the Leeward Islands. Compiled by FREDERICK HENRY WATKINS, I. S. O. Published by authority of the Government of the Leeward Islands, by the Crown Agents for the Colonies. London, West India Committee, 1924. 308 pages. Price, 10/6.

Contains a chronological history, description and historical sketch of the islands of Antigua, St. Christopher-Nevis, Dominica and Montserrat, with maps and illustrations. Also special chapters on the commerce and agricultural industries, with tables of the fruits and vegetables, and their seasons, the animals, fishes and birds of the Leeward Islands.

CHARLOTTE L. CARMODY.

THOMAS, LOWELL. *Beyond Khyber Pass.* 253 pp., 123 ill. The Century Book Co., London and New York, 1925. $4.00.

Beyond Khyber Pass is a most interesting story of the travels of the author and his photographer in Afghanistan and the borderland to the east. This region, though crossed by a very ancient trade route, is little known and any additional information concerning it is of value.

The book is largely given to a characterization of these mountain peoples. They are portrayed as liberty-loving and independent, as looking with suspicion and hatred on the outside world and as settling local difficulties with bullets, knives, and poison. The geographer will be disappointed that little is given of the cultural landscape of the country and of the occupations of the peoples, though bits of such information are dropped here and there. The reader is

impressed with the difficulties and dangers of traveling in this area and with the excessive temperatures during the heat of the day. High temperatures are frequently mentioned but always in round numbers, such as 130 degrees in the shade and 150 degrees in the sun, so that one suspects the author is expressing his general impressions rather than scientific data. The pictures (123 in number) are a very valuable part of the book.

EARL C. CASE.

DAKE, C. L., AND BROWN, J. S. *Interpretation of Topographic and Geologic Maps.* x and 355 pp. McGraw-Hill Book Co., New York, 1925. 7½ x 5 inches. $3.00.

Not since Professional Paper No. 60 of the United States Geological Survey, by R. D. Salisbury and W. W. Atwood, was issued from the government press in 1908, has there been any serious attempt to present this fundamental information in a comprehensive and general way. Just as the student was beginning to find it difficult to obtain copies of the earlier incomparable work, and as the teacher and the scholar were beginning to feel the need of a more up-to-the-minute guide, along comes this very excellent little volume, more inclusive than its famous predecessor in that it takes up geologic maps and folios as well as topographic, but somewhat less convenient in that the maps are not part of the volume and must be obtained separately. The expense of publication precluded the possibility of making the maps an integral part of the volume.

As basic preparation for an intelligent study of geography, for vigorous teaching of geographic courses, for a sound interpretation of economic principles as originating in physical laws, a working knowledge of topographic and geologic maps and the facts that they graphically express, is essential. Without the ability to understand maps, to read from them the full meaning which they are prepared to represent, and even to prepare the maps when occasion arises, no teacher or student of geography can hope to progress far.

It is safe to say that should this little volume meet the welcome, and find the extensive use, that it deserves, many new courses in map interpretation will be added to the curricula of geology and geography departments of colleges and universities throughout the country; and as a consequence political, commercial, economic, and agricultural geography courses will be more substantially grounded on basic facts.

An admirable attribute of the volume is its size, which permits its being included in field course libraries without its adding materially to the impedimenta. It fits into the coat pocket or into the knapsack without being a burden. As a guide in the classroom or the map laboratory it is equally convenient.

Despite the lack of accompanying maps the book deserves to become popular, and probably will make for itself a place on the ready reference shelf of every student in geography.

W. ELMER EKBLAW.

DAVIS, WATSON. *The Story of Copper.* xix and 385 pp.; ills., diagrams, index. The Century Company, New York, 1924. 5½ x 8 inches. $3.00.

The Story of Copper by Watson Davis, managing editor of *Science Service*, is a rich and stimulating narrative of the romance of this metal, ages old yet so new in its modern applications. It takes the reader on the wings of the imagination back to the dim and distant past when Neolithic man first and accidentally learned to use copper and thus brought in a new era in the slowly rising tide of civilization. It traces the threads of the copper story through the ages and weaves the fabric of the copper net which serves to turn night into day, to carry the voice of man around the world, and to harness the energy of the rushing mountain streams.

The genesis of copper, the known reserves in the world's production, the recovery of the metal —mining—concentration—leaching or smelting and casting, copper's chemistry, copper alloys, copper's part in the home, the service of brass and bronze in modern wars, and the part of copper in the history of art—all these technical and difficult subjects and more receive fascinating but simple treatment. As a matter of fact, the most striking feature of the book is the direct and intelligible, yet interesting and stimulating, manner in which the many copper ramifications and the complex processes involved are elucidated.

A valuable part of the volume consists of the "Reading References on Copper," pp. 365–380. These give in more detail than is possible in one volume a thorough knowledge of certain phases of the history, nature, manufacture and use of copper. The reading of *The Story of Copper* by the general public to which the volume is addressed will lead to a genuine appreciation of this valuable metal.

CLARENCE F. JONES.

HUNTINGTON, ELLSWORTH. *West of the Pacific.* xv and 453 pp.; well illustrated. Charles Scribner's Sons, New York, 1925. 9 x 6 inches. $4.50.

This account of a voyage of a geographer is not intended as a text-book, nor yet as a reference book; it is a record of impressions, a reproduction of mental pictures as seen from a geographer's point of view, and pretends to be nothing else. So well chosen are the views of the lands and their people presented in both the text and the illustrations, that after the reader has been lured through the whole book by its frank tantalizing style, he has learned a great deal of geography, probably

more than he would from many another volume avowedly more statistical, more scientific in purpose and plan; and he would most certainly have a sympathetic, understanding knowledge of the limitations imposed upon the crowded peoples of the lands "west of the Pacific" by the physical environments which constitute their homelands.

The journey of which Doctor Huntington relates his wayside impressions was his first long trip for eight years, a time spent in study and research along the lines of his chief interest, the effect of physical environment, especially climate, on human occupations, health, activity, habits, and character. To quote his own words, "Having broadened my mental outlook, I feel almost like a new traveler. In spite of nearly six years of previous travel and four years of foreign residence, I experienced the keen pleasure of seeing not only the old kinds of facts in new countries, but new kinds of facts to which my eyes were formerly closed," is to indicate the enthusiasm, as well as the maturity of judgment, he reflects in this narrative of his observations.

A month in Japan under the most competent native guidance; a week in Chosen (Korea); brief stops in the Philippines; seven weeks in Australia, much of the time in company with such well-informed men as Professor Griffith Taylor and Doctor E. C. Andrews; two weeks in Java, personally guided by Doctor van Valkenberg; and five weeks traveling along the Chinese coast from Canton to Shanghai, and thence by rail to Peking and Mukden; these constituted the period and extent of travel upon which this interesting book is based.

To give the impression that *West of the Pacific* is merely entertaining, perhaps superficial, would be unjust. It is entertaining indeed, but it is also a storehouse of geographic fact and correlations; and a deep application, resultant upon long years of profound research, of values and interrelationships in the interpretation of the life of the several peoples visited, makes Doctor Huntington's book a valuable contribution to our geographical literature. Every school library will find a place for it, and teachers and pupils alike will delight in its clear pictures of the lands west of the Pacific.

W. ELMER EKBLAW.

NANSEN, FRIDTJOF. *Hunting and Adventure in the Arctic.* 462 pp. Illustrated from drawings by the Author. Duffield and Company, New York, 1925. 9 x 6 inches. $4.00.

Authoritative, well-considered books on the Arctic, free from exaggeration or controversial detail, are all too few; and though "Hunting and Adventure in the Arctic" is in no wise a geographic treatise, it contains so much of genuine, definite value, in the accurate and careful observations by this veteran explorer and statesman, that our Arctic literature is enriched by the addition of the volume to our geographic libraries.

The data on ice conditions and climate, on water temperature and cloud movement, on winds and water currents, while not in tabulated form, are a valuable part of the book, and in their setting of seal-hunting activities, help to give a scientific background to the daily adventures of the seal-hunting ships.

These Norwegian and Scotch sealers formerly went every spring to the edge of the polar pack ice drifting out to Denmark Strait, where the harp seal and the hooded seal particularly, frequent the floes and give birth to their young, and with good luck filled the holds of their ships with the skins and blubber of these animals; a small fortune or at least a comfortable competence followed a good kill, but disappointment upon a return without having discovered the breeding grounds. For finding the breeding seals was sheer good fortune. The drift of the ice, its thickness, its distribution determined the location of the breeding-grounds, and their accessibility. The day of huge kills is past, though sealers and whalers occasionally still make profitable trips to the edge of the ice.

The habits of the seals, the polar bear, the bottlenose whale, and some of the sea birds are rather well depicted; the formation of sea ice is accurately described; and all in all, the book is worth while.

W. ELMER EKBLAW.

OUR CONTEMPORARIES

THE BULLETIN OF THE GEOGRAPHICAL SOCIETY OF PHILADELPHIA

Vol. XXIII, No. 4. October, 1925

The Ascent of Mount Logan. 12 pages. Allen Carpe.

Maui and the Maui Group, Hawaii. 19 pages. Norman E. A. Hinds.
A source of geographic information about this group.

Geographic News and Notes.

Activities of the Society.

Index to Vol. XXIII.

THE JOURNAL OF GEOGRAPHY

Vol. XXIV, No. 7. October, 1925

The Economic Geography of Norway. 17 pages. Nels A. Bengston.
A valuable compilation of economic material, especially for the teacher.

The Grain Trade of the Great Lakes. 7 pages. Loyal Durand, Jr.
Brief, but thoroughly informative. A good article.

Spain and Portugal: A Sixth Grade Project. 9 pages. Elizabeth D. Zachari.

The Age of the Earth. 4 pages. U. S. Grant.

A Questionnaire on the Geography of Alaska. 1 page. Louise Mears.

National Council Meeting.

Geographical Publications.

Vol. XXIV, No. 8. November, 1925

Lake Wakatipu and the Remarkables. 13 pages. Waldo S. Glock.

The Geographic Provinces of Argentina. 14 pages. O. W. Freeman.
A compact presentation of essential economic facts.

High School Geography. 10 pages. Clare Symonds.

The Great Plains Questionnaire for the Study of the Sod House as a Form of Shelter. 2 pages. Louise Mears.

National Council Meeting.

Geographical Publications.

Vol. XXIV, No. 9. December, 1925

Jugoslavia. 14 pages. F. M. Sanders.
A regional economic study of much interest and value by an author who has traveled over the region with which this article is concerned. A first class presentation of important material.

Geography as a Social Science in the Junior High School. 9 pages. George J. Miller.

Sheep and Human Affairs. 8 pages. Frances S. Hay.
An interesting compilation, chiefly of value to the teacher.

A Project for the Study of Home Geography. 1 page. Alice Bundy.

The Beautiful in Geography. Editorial.

The National Council Meeting.

Geographical Publications.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. XLVIII, No. 4. October, 1925

The Romance of Science in Polynesia. 56 pages. Robert Cushman Murphy.
Embodies many observations of Economic Interest.

Iridescent Isles of the South Seas. 16 pages.

Collarin Cape Cod. 46 pages. Lieutenant H. R. Thurber. U. S. Navy.

MacMillan in the Field. 3 pages.

Vol. XLVIII, No. 5. November, 1925

The MacMillan Arctic Expedition Returns. 42 pages. Donald B. MacMillan.

Flying Over the Arctic. 14 pages. Com. Richard E. Byrd, U. S. Navy (Ret.).

History's Greatest Trek. 42 pages. Melville Chater.
A picture background for appreciation of the economic problems of the Near East.

Sun Painted Scenes in the Near East. 14 pages. Gervais Courtellement.

Vol. XLVIII, No. 6. December, 1925

The Taurine World. 99 pages. Alvin Howard Sanders. D.Agr., LL.D.

The Cattle of the World. 20 pages. Edward Herbert Miner.

Two excellent articles, essentially economic, that are of much interest to geographers, agriculturists, and even historians. The descriptive text is unusually satisfactory, and the illustrations, as always, superb.

THE JOURNAL OF LAND AND PUBLIC UTILITY ECONOMICS

Vol. I, No. 4. October, 1925

Commercial Vehicles on Free Highways. 12 pages. T. H. MacDonald.

Large Land Holdings in North Dakota. 7 pages. Aldo Leopold.

Influences of Customer Ownership on Utility Financial Structure. 9 pages. Alva H. Bickley.

The Landless Agricultural Laborer in Italy. 10 pages. Asher Hobson.

Some Aspects of the Going-Value Concept in Utility Valuation. 9 pages. Martin G. Glaeser.

The Trend of Real Estate Taxation in Kansas. 1910–1923. 15 pages. Eric Englund.

Influence of Customer Ownership in the Financial Structure of Public Utilities. 10 pages. Henry P. Bruner.

Increments in Land Values in Philadelphia. 9 pages. W. N. Loucks.

Scientific Real Estate Merchandising—the Professional Ideal. 21 pages. A. G. Hinman.

Summaries of Research.

Comments on Legislation and Court Decisions.

WORLD AGRICULTURE

Vol. V, No. 1. Spring, 1925

Dry-Farming Number, Part I

Agriculture in Semi-Arid Lands. 3 pages. The Editor.

Dry-Farming in the State of Washington. 1 page. Supt. M. A. McCall.

Shelterbelt Trees in the Northern Great Plains Section of the United States. 1 page.

Dry-Farming in Kansas. 1 page. Prof. L. E. Call.

Opportunities in the Texas Panhandle. 1 page. Sec. W. N. Blanton.

The Consolidated School. 1 page. Prof. C. G. Sargent.

The Importance of the Silo in Dry-Land Farming. Supt. J. W. Adams.

The International People's College of Denmark. 3 pages. Prin. Peter Manniche.

The Boyce Thompson Institute for Plant Research. Prof. H. Findlay.

Departments:
The Home Garden.
Use of Foods.

Vol. V, No. 2. Summer, 1925

Dry-Farming Number, Part II

Soil Management Under Dry-Farming. 2 pages. Profs. George Stewart and A. F. Bracken.

Special Dry-Land Crops. 1 page. The Editor.

Dry-Farming as a Means of Preventing a Repetition of the 1921 Tragedy in the Volga Region of Russia. 1 page. Prof. N. Tulaikov.

Planting the Nebraska Sand Hills. 1 page. H. R. Kylie. U. S. Forest Service.

The Respective Domains of the Farmer and the Grazier. 1 page. Director B. Youngblood.

Farmers and Books. Librarian, Milton J. Ferguson.

Out in the Canadian West. 4 pages. Rev. Francis W. Pattison.

International Conference of Agricultural Organizations. Dr. E. Laur's Committee.

The World Agricultural Society. The Executive Secretary.

Departments:
Agricultural Missions.
Among Our Members.
An Ear to the Ground.

Vol. V, No. 3. Autumn, 1925

Berne Conference Number

The Conference at Berne Takes the Second Step Towards an International Alliance of Agricultural Organizations. 1 page. Editorial.

Conference Internationale des Organizations Agricoles. Dr. E. Laur.

List of Delegates to the Berne Conference. 1½ pages.

Proposed "Articles of Association" for the "International Conference of Agricultural Organizations." 4 pages. Dr. Laur's Committee.

Making the Desert Bloom in Normandy. Rev. George L. Thompson.

The World Agricultural Society. The Executive Secretary.

Departments:
Among Our Members.
Agricultural Missions.

NEWS ITEMS

UNIVERSITY OF CALIFORNIA

Department of Geography

Mr. R. J. Russell, an associate in the department, is completing his dissertation on the Warner Mountains, a geologic thesis which contributes some important knowledge on the morphologic processes so fundamental to geographic science.

Mr. J. B. Leighly is studying in Sweden, gathering material for a study in urban morphology, which will constitute the theme of his thesis.

Dr. Schneider, who continues his successful courses on South America, is preparing his Bolivian studies for publication.

The department has reopened its series of publications by a paper entitled "Morphology of Landscape" by Carl O. Sauer, which has just recently come off the press. Other papers will soon follow.

UNIVERSITY OF MINNESOTA

Department of Geography

The department of geography, which was created last year, now has new and permanent quarters in a building shared with history and political science. Adequate and well equipped classroom, office, and workroom space, together with provision for necessary future expansion, provide opportunity for enlargement of the department activities.

Professor Davis' report on the blue grass region of Kentucky, one of a series of regional studies carried on under the auspices of the Kentucky Geological Survey, is now in the process of publication.

Dr. Richard Hartshorne spent the past summer in Europe, dividing his time between England, France, Germany and Switzerland.

Prof. J. Paul Goode of the University of Chicago spoke at the Minnesota Education Association meetings in November, both before the geography and joint social science sections and the general meeting. Professor Davis and Dr. Hartshorne also read papers in the geography section meeting.

Mr. Daniel Bergsmark, assistant in geography and a graduate student in the department, is engaged in a geographic field study of the Princeton (Minnesota) community.

Dr. Raphael Zon, director of the Lakes States Experiment Station, discussed our forest resources at the December meeting of the Twin City Geography Club.

Professor Davis read a paper on "Climatic Change as a Factor in Lowered Lake Levels" before the Minnesota Chapter of the Society of American Foresters at their December meeting. This was one of a series of papers dealing with the question of lowered lake levels.

UNIVERSITY OF CHICAGO

Department of Geography

At the close of the summer quarter the Doctor's degree in geography was conferred upon Lewis F. Thomas, associate professor of geography in Washington University, St. Louis. The title of his dissertation is "The Localization of Business Activities in Metropolitan St. Louis." At the same convocation the Master's degree was granted to Edwin J. Foscue, and Louise G. Ramsdell. Mr. Foscue, whose promotion to an assistant professorship in geography in the Southern Methodist University, Dallas, was noted in the News Letter of last June, discussed in his thesis the "Economic Geography of the Mesilla Valley of New Mexico." Miss Ramsdell considers in her thesis "Forests and Forest Resources as Factors in the Economic Development of New England." Miss Ramsdell is head of the department of geography in the State Normal School at Framingham, Massachusetts.

At the December convocation Samuel T. Bratton, associate professor of geography in the University of Missouri, received the Doctor's degree, and the Master's degree was granted to Margaret Warthin and Edna Brown. Mr. Bratton's dissertation is concerned with "The Geography of the St. Francis Basin," Miss Warthin's thesis with "Industrial Relationships in the Geography of Alpena, Michigan," and Miss Brown's thesis with the "Timber Industries of British Honduras."

Upon recommendation of Secretary Hoover, President Coolidge recently appointed Helen M. Strong, geographic expert of the Bureau of Foreign and Domestic Commerce, to membership on the United States Geographic Board, as a representative of the Department of Commerce. An article by Miss Strong on "Cleveland: A City of Contacts" appeared in the July issue of Economic Geography. She also has contributed several articles to recent issues of Commerce Re-

ports, one of which was accompanied by a dot map showing the distribution of world-population. The value of the map is enhanced by the fact that it is drawn on an equal-area projection.

Bert Hudgins has been promoted to a full professorship in geography in the College of the City of Detroit. The College is a part of the public school system of Detroit, and a recent outgrowth of the Detroit Junior College, which was organized a decade ago.

A new graduate field course in chorography will be announced in the next circular of the department. A small area of geographic diversity will be investigated intensively, with the object of producing on the ground a completed monograph in the field of regional geography. Text, maps, diagrams, and photographs will be prepared as the work progresses. The area tentatively chosen for 1926 lies in the Upper Connecticut Valley. Striking diversity in natural environment, reflected in varied human life, is encompassed within a few square miles. This will afford an opportunity for intensive and diverse studies with the minimum number of camp sites. The party will enter the area, in which the second term of the summer quarter will be spent, via the St. Lawrence Lowland and French Canada, and will leave it via southern New England and New York City. Since the class will be limited to twelve persons, former students who wish to take the course would do well to correspond with the instructor, Mr. Whittlesey, at an early date.

Bulletin No. 16 of the Bureau of Meteorology of the Commonwealth of Australia is a detailed discussion of "Australian Hurricanes and Related Storms" prepared by Stephen S. Visher and D. Hodge, commonwealth meteorologist. The *Annals of the Association of American Geographers* for June contains an article by Mr. Visher on the "Regional Geography of Southeastern Wyoming from the Viewpoint of Land Classification." In the same number of the *Annals* W. H. Haas briefly considers neglected field for geographic research under the title "The American Indian and Geographic Studies," and D. H. Davis writes of "Urban Development in the Kentucky Mountains."

Rand McNally and Company announce the completion of the New Goode Political 16-inch Globe.

At the meeting of the geography section of the Indiana State Teachers Association on October 22 in Indianapolis, papers were given by Stephen S. Visher, Bernard H. Shockel, and Charles C. Colby. Mabel Washburn was elected president of the Section for 1926.

Leavelva Bradbury addressed the meeting of the geography section of the Central Association of Science and Mathematics Teachers in Rosenwald Hall on November 27. The title of her paper was "Students' Habits of Study and Appreciation of Geography." Mr. Whittlesey spoke on "Schemes for Presenting Regional Geography."

Jane K. Atwood resigned the position which she held for years in the State Normal School at Emporia, Kansas, to accept an assistant professorship in geography at Ohio University, Athens, Ohio. Guy A. Buzzard is now in charge of the geography work at Emporia.

Mr. Jones and V. C. Finch make some novel and valuable suggestions concerning "Detailed Field Mapping in the Study of the Economic Geography of an Agricultural Area" in a paper which appears in the September issue of the *Annals of the Association of American Geographers*. The paper presents the joint conclusions of a group which met for conferences on geographic field mapping in May, 1924, at Bagley, Wisconsin, and in May, 1925, at Hennepin, Illinois. The members of the group were Messrs. D. H. Davis (Minnesota), Finch (Wisconsin), Haas (Northwestern), Lobeck (Wisconsin), McMurry (Michigan), Parkins (George Peabody), and, from the Department, Colby, Jones, Platt, and Whittlesey.

"The Homolosine Projection, a New Device for Portraying the Earth's Surface Entire," is the title of a paper by Mr. Goode in the September number of the *Annals of the Association of American Geographers*.

Two courses will be given in the department next summer by Dr. Helge Nelson, professor of geography in the University of Lund, Lund, Sweden. Professor Nelson has briefly outlined the nature and scope of his courses as follows: "Human Geography": principles of human geography; the distribution of mankind on the earth; man as a geographic factor; the distribution of cultivated lands; types of cultivated landscapes in various parts of the world; the industrial landscape; the settlement of an area; urban geography. "Comparative Regional Geography" (Europe and North America): studies of the geographical individuality of Europe and North America, with emphasis upon similarities and differences in the adjustment of human activities to the natural environment in the two continents. A stimulating article in English by Professor Nelson, on "The Interior Colonization in Canada at the Present Day, and Its Natural Conditions," appeared in *Geografiska Annaler, 1923*. Professor Nelson will be the fifth eminent geographer to give instruction in the department since 1920.

Mr. Coulter is president of the Geophoto Club of the University.

A "Geography Club" recently was organized by the graduate students of the department. Clyde J. Bollinger is president, Will T. Chambers, vice-president, and Mary Mathews, secretary-treasurer.

J. P. Carey has been appointed assistant professor of geography in the Central State Normal School, Mt. Pleasant, Michigan.

Among the organizations to which Mr. Goode has lectured during the last month are the Minnesota Educational Association, the Chicago Owners and Managers Association, the Chicago City Club, and the Chicago Association of Commerce. He also gave, on October 13, the first of the current series of University lectures in Orchestra Hall, his subject upon that occasion being "The Geographic Background of Chicago, a City of Destiny."

William P. Holt is in charge of the work in geography in the State Normal College, at Bowling Green, Ohio.

Guy V. Richey, a graduate student in the department last year, went in September to the Stephen F. Austin State Teachers College of Nacogdoches, Texas, as head of the department of geography.

UNIVERSITY OF ILLINOIS

DEPARTMENT OF GEOGRAPHY

Three graduate students are preparing Master's theses as follows: Vera Goessling, "Summer Township, Champaign County, Illinois, A Study of the Results of Drainage"; E. Goebel Savage, "Geographical Aspects of the Boundaries of the United States"; E Utzig, "Geographical Factors Influencing Agriculture in Champaign County, Illinois."

Miss Goessling, assistant in the department, has resigned her position, to take effect at the end of the first semester. Miss Lylian Block will take Miss Goessling's place.

"The Iron and Steel Industry of the Calumet District," a doctorate thesis of Prof. J. B. Appleton will appear as the next number of the *University of Illinois Studies in Social Science.* Mr. Appleton is planning on going abroad the coming summer and will gather considerable additional material for a geography of Europe, a textbook being prepared in collaboration with W. O. Blanchard.

W. O. Blanchard has been promoted from assistant professor to associate professor of geography.

Mr. E. W. Cox spent considerable time in the past summer in field studies of Lawrence County, Illinois.

CLARK UNIVERSITY

DEPARTMENT OF GEOGRAPHY

Dr. C. F. Marbut carried out his program of about twenty-five lectures on soils during the latter part of the first semester.

Dr. O. E. Baker was the speaker at the January meeting of the Worcester Economic Club. He spoke on economic problems before the farmers of this country, to an audience of about five hundred business men of the city.

Dr. Bruno F. A. Dietrich, of the University of Breslau, visited the University in November. He spoke to the geography group on the present trend of geography in Germany, and to a public audience on "Present Economic Conditions in Germany."

With the opening of the second semester, February 1, the following additional graduate students will take up residence work at Clark: C. J. Bollinger, Maude C. Martin and L. C. Krebs.

At the Founder's Day exercises, held on February 1, Mr. Olof Jonasson will receive the degree of Doctor of Philosophy. His thesis on Agricultural Regions of Europe appeared in two parts in ECONOMIC GEOGRAPHY. The second part is in the current number.

During the last month there has appeared from the press of Houghton, Mifflin and Company a volume by Dr. D. C. Ridgley, entitled "Geographic Principles."

There has just appeared from the press of A. J. Nystrom and Company a manual on "The Problem Method in Comparative Map Studies," prepared by Wallace W. Atwood and Harriet T. B. Atwood. The first edition of the Atwood Regional-Political Series of Ten Wall Maps has been exhausted, and the plates are on the press for a second edition.

Dr. Wallace W. Atwood has been appointed delegate to the Third Pan-Pacific Science Conference to be held at Tokio during October and November, 1926.

Preliminary plans have been announced of a European field trip in geography under the leadership of Dr. Wallace W. Atwood and Prof. W. H. Barker, of the University of Manchester, England, for the summer of 1927.

Preliminary plans have been made for continuation of field studies in the northern countries of South America by Clarence F. Jones during the summer of 1927.

Dr. D. C. Ridgley has been selected as ge-

ographer for the world tour for college men to be conducted under the auspices of the New York University in 1926–27.

Mr. W. Elmer Ekblaw will teach in the University of Iowa for the summer session of 1926.

Doctors Atwood, Brooks, Ridgley and Jones will instruct at the Summer School in Geography during July and August of 1926.

Rollin S. Atwood will offer work in geography at Bucknell University for the summer session of 1926.

Mr. Harley P. Milstead, graduate student, has accepted an invitation to teach geography at the Illinois State Normal University during the summer of 1926.

Miss Ella B. Knight, who has been in residence as a graduate student, will return to her work in Omaha at the opening of the next semester.

Dr. D. C. Ridgley has just completed a series of fifteen lessons in Schenectady, New York. These lectures were planned to assist the teachers of that city in the reorganization of their course of study in geography.

GENERAL

Field Meeting of the Association of American State Geologists

The annual fall field meeting of the Association of American State Geologists was held October 12 to 16 in eastern Pennsylvania, the Pennsylvania Geological Survey acting as host. Early arrivals were entertained Sunday evening at the homes of Dr. George H. Ashley and Mr. R. W. Stone. Four days were spent in the vicinity of Harrisburg, Hummelstown, Cornwall, Port Clinton, Pottsville, Mahanoy, Hazelton, Mauch Chunk, Lehigh Gap, Slatedale, North Hampton and Nazareth in observing the excellent exposures of the stratigraphy and structure, in observing the remarkable peneplain remnants, and in reviewing the mineral resources of that part of the State, including the southern anthracite field, the slate area, brownstone quarries, cement plants, and the Cornwall magnetite mine. Evenings were devoted to discussions of matters pertaining to state survey policies and activities and to discussions of the geological problems of the areas covered. The state geologists were accompanied by a number of guests, including Dr. W. C. Mendenhall, Chief; Messrs. E. O. Ulrich, Charles H. Butts, Dr. David White, chairman of the Division of Geology and Geography, and Dr. Albert L. Barrows, chairman of the Divison of States Relations, National Research Council. Professor Miller of Lehigh University, Judge James R. MacFarlane of the Court of Common Pleas, Pittsburgh, and members of the Pennsylvania Geological Survey. The following state geologists represented their respective surveys: George H. Ashley, Herman Gunter, H. B. Kummer, M. M. Leighton, Raymond Moore, M. W. Twitchell, Wilbur A. Nelson, and David Reger (representing I. C. White). The meeting closed at Bethlehem, Pennsylvania, with a dinner at Hotel Bethlehem, at which President Richards, of Lehigh University, and a number of the faculty were present.

The Association acknowledges the many helpful courtesies extended by the various mineral industries visited.

ANNOUNCEMENT

Agricultural Regions of Europe, by Olof Jonasson, the carefully prepared and well illustrated article concluded in this issue of ECONOMIC GEOGRAPHY, begins the series of six articles which, when completed, will constitute a complete and comprehensive treatment of *Agricultural Regions of the World*.

The second in the series, *Agricultural Regions of North America*, by O. E. Baker, based on the most accurate and authentic data available at the time of going to press, will follow in the April issue; the third in the series, *Agricultural Regions of South America*, by Clarence F. Jones, who has recently returned from an extended journey through South America, will appear next June.

The series will continue in succeeding issues with separate articles on *Agricultural Regions of Asia, of Africa, and of Australia*.

One series of maps of adequate dimension will accompany the articles to indicate these *agricultural regions* and another series to indicate the *regions of land utilization* as fully as accurate data are available. Smaller maps, charts and pictures will further illustrate the articles.

To obtain the complete series of these extremely valuable articles which present for the first time on such a comprehensive and accurate basis the significant divisions of the world's most important industry, it will be necessary to subscribe at once for ECONOMIC GEOGRAPHY, and date back to the October issue.

In addition to this series of articles on agriculture, an industrial series will be initiated soon; every issue will also contain four or five other articles dealing with urban and regional geography, with problems of land utilization, with programs of development of resources, with commerce, with transportation, with health, and with the hundred and one other subjects that are of present geographic interest, all by the most competent and best informed authorities in their respective fields. ECONOMIC GEOGRAPHY is indispensable to the intelligent citizen.

The subscription price for the United States and possessions is $4.00 the year or $7.50 for two years. To all foreign countries, $4.50 the year or $8.50 for two years. Address ECONOMIC GEOGRAPHY, Clark University, Worcester, Mass., U. S. A.

ECONOMIC GEOGRAPHY

A QUARTERLY journal of Economic Geography published by Clark University for the benefit of geographers, economists, teachers, professional and business men, and all who are interested in the intelligent utilization of the world's resources.

Subscription, $4.00 the year in the United States and its Territories; $4.50 the year beyond the borders of the United States.

Only a limited number of the first issue of ECONOMIC GEOGRAPHY are available. This issue includes the following articles:

The Relation of Geography to the Timber Supply, W. B. Greeley, U. S. Forestry Service.
Geography and Wheat Production, O. E. Baker, Economist, U. S. Bureau of Agricultural Economics.
The Grain Trade of Montreal, Clarence F. Jones, Professor of Economic Geography, Clark University.
The Coal Resources of Canada, M. J. Patton, Economist, Natural Resources Intelligence Service, Dominion of Canada.
A Land Policy for the Public Domain, George R. Stewart, Agronomist, Utah Agricultural Experiment Station.
Map Studies of Population and Cultivated Lands in Scandinavia, Olof Jonasson, Economic Geographer, Geographic Institute of Stockholm, Sweden.

The second issue, of which numbers can still be obtained, contains the following articles:

A World of Power, George Otis Smith, Director, U. S. Geological Survey.
The Distribution of Domestic Animals, Ellsworth Huntington, Climatologist, Yale University.
The Apple Industry of the Annapolis-Cornwallis Valley, Charles C. Colby, Economic Geographer, University of Chicago.
Cleveland: A City of Contacts, Helen M. Strong, Geographic Expert, Bureau of Foreign and Domestic Commerce.
The Insular Integrity of Industry in the Salt Lake Oasis, Langdon White, Economic Geographer, Clark University.
The Geographic Effects of the Proposed Great Lakes-St. Lawrence Waterway, W. S. Bayley, Geologist, University of Illinois.
Geographic Factors in the Development of Transportation in South America, Preston E. James, Assistant Professor, University of Michigan.

Copies of these numbers will be sent to any American address for $1.25 each; to any foreign address for $1.50.

Separates may be obtained as follows:

The Relation of Geography to the Timber Supply, W. B. Greeley, 14 pp. Price, 50 cents.
Geography and Wheat Production, O. E. Baker, 37 pp. Price, 75 cents.
Both Booklets for $1.00.

A limited number of separates of other articles in the March, July, and October issues are still available at the rate of 2½ cents per page per copy.

Send all subscriptions and orders to

ECONOMIC GEOGRAPHY,
Clark University, Worcester, Mass., U. S. A.